MOSSES OF THE NORTHERN FOREST

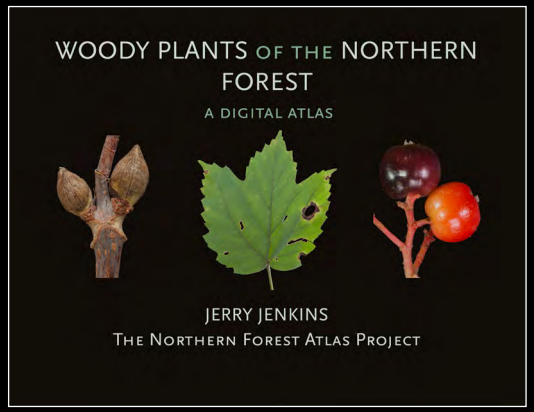
A DIGITAL ATLAS

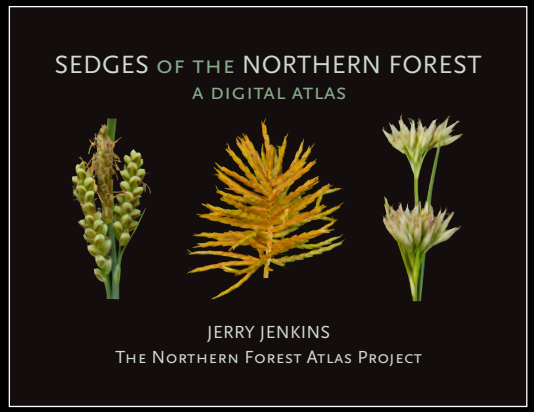
JERRY JENKINS and SUE WILLIAMS

THE NORTHERN FOREST ATLAS PROJECT

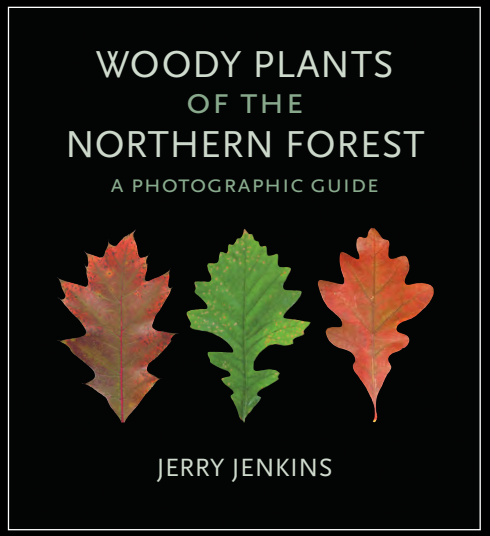
PUBLICATIONS OF THE NORTHERN FOREST ATLAS PROJECT

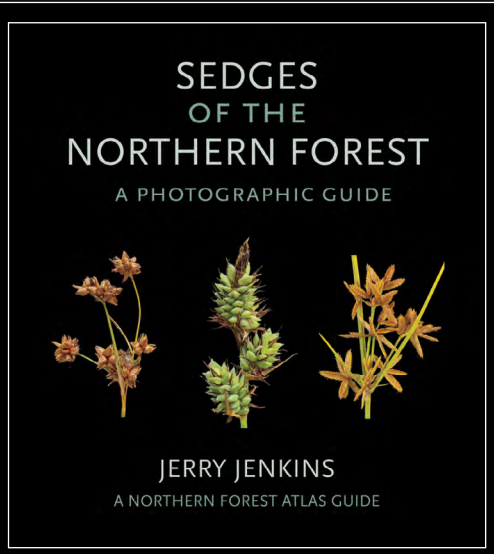
DIGITAL ATLASES

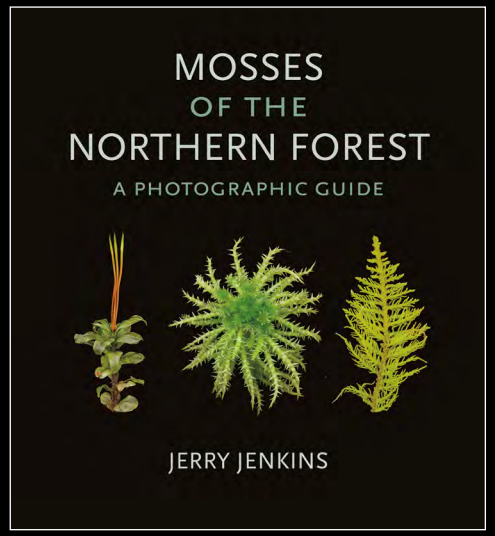




PHOTOGRAPHIC GUIDES





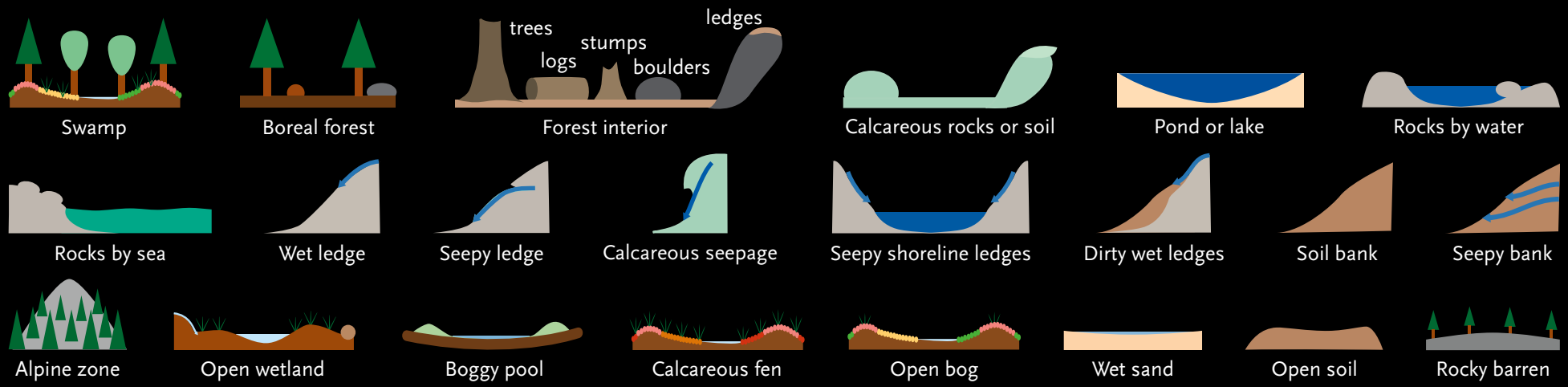


WATERPROOF FOLDING CHARTS

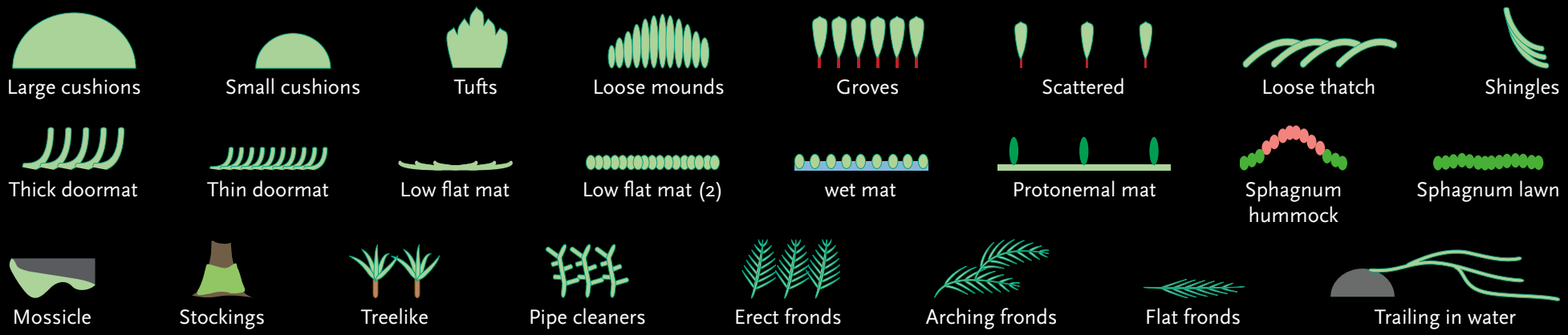
As of spring, 2020, the Atlas Project has produced digital atlases, paper photographic guides, and folding charts to woody plants, sedges, and mosses. The digital atlases are available for download from our website, northernforestatlas.org; the photographic guides and charts from Cornell University Press, cornellpress.cornell.edu. Photographic guides to grasses, a digital atlas of grasses, and a book-length field guide to woody plants will be published in 2022.

ICONS

HABITATS



GROWTH FORMS



FLAGS

LINKS & CONTROLS The entries are alphabetic by genus and can be accessed through the Bookmarks pane of the PDF viewer. Click on the ribbon icon. On PCs, *Ctrl L* toggles full-screen mode, which is the best way to view. *Crl* + and *Crl* -zoom in and out. On Macs, the "Apple" key, next to the spacebar, plus *L* toggles full-screen mode. The same key plus *Y* allows you to put in a magnification and then pan. Try 300% or 400%; there is a lot of detail in the images. Remember that most species have several more pages of illustrations past the bookmark.

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This is a digital atlas of the bryophytes of the Northern Forest region. It covers about 305 species and has about 1,650 images and 400 diagrams. It is built around studio macrophotographs shot at image magnifications of 0.5 × to 10 ×. The image can be zoomed to full screen or beyond, giving viewing magnifications up to about 70 ×, depending on the image. We also have field and habitat photos, though fewer than we would like.

Our object is to provide photos of northern bryophytes at scales ranging from landscape to near microscopic. The small scales (close-ups) are required to identify them and understand how they grow. The large scales are required to find them in the field and understand how they function in the landscape.

Achieving this is, of course, much harder. Getting good pictures in the studio is not too hard, at least for the mosses that can be removed from their clumps and photographed in silhouette. The keys are good specimens, good lights and lenses, and a lot of practice. Getting good pictures in the field is harder. The keys seem to be good weather and light, an eye for what is photographable and what isn't, and a lot of luck and patience.

The field pictures here were shot over twelve years, from 2009 to 2020; the studio pictures over nine years, from 2012 to 2020. They are selected from a total of about 10,000 moss pictures taken in that period, record what we learned, about photography, mosses, and the world, in a wonderful decade of our lives. Many are not as good as we wish. All have something we want you to see.

Ed McNeil created the Atlas Foundation and has guided the project for nine years. Jerry Jenkins took the photos, drew the diagrams, and wrote and designed the book. Sue Williams found many of the specimens, verified many others, discussed almost every point of identification and detail, and edited the book. Susan Alancraig did the page layouts. A whole community of bryologists has helped us find mosses and understand them. A wonderful group of donors supports us.

Three notes to start you off. First, most of the images here are composites of many separate exposures. They have more detail than you can see in a full page view, and we encourage you to zoom in and look closely.

Second, moss identification, even of the common species, is often hard. The pictures and diagrams here will help, but are just a start. You need other books, and, because science is a conversation, the more you learn the more books you will need. Start with our moss book, *Mosses of the Northern Forest,* and its companion set of moss maps, from Cornell University Press. They work well with the atlas. Go on from there.

Last, remember that magnification poses as many problems as it solves. Most mosses, looked at closely enough, are confusing. We take this as a lesson. We can introduce you to them and give you an entry point. But once you are beyond the door, you are on an adventure. Mystery is the point, not clarity. And mystery, we have on ancient authority, is where everything begins.

NFAP

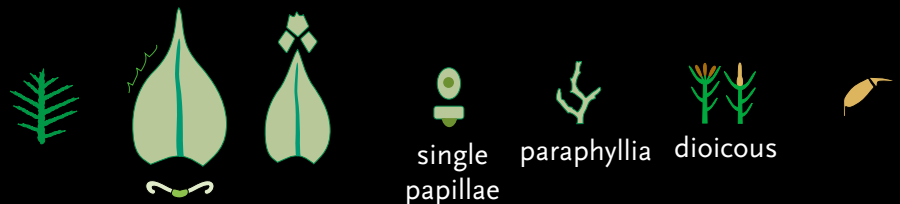
The Northern Forest Atlas Project
www.norternforestatlasproject.org

ABIETINELLA ABIETINA Sparse, wiry, once-pinnate, cells with single papillae. Terminal cells of branch leaves with two or three points.

Common species of dry exposed limy soil. Plants light yellow-green, stiff, sparse, arching, and wiry, always once-pinnate; terminal cell of branch leaves with several points. *Cyrto-hypnum* and *Rauiella* are similar but usually smaller, often on trees, and always with several papillae per cell. *Haplocladium virginianum* is similar but smaller and flatter to the substrate and usually on acid rocks or soil. The terminal cells of its branch leaves have single points.

Calcareous rocks or soil

Loose thatch



C

Common in right habitat

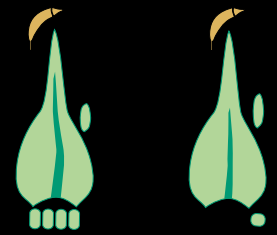
Slender, tapering branches, arching growth. *Heterocladium dimorphum* is smaller and the branches taper less.
With *Tortella tortuosa, Syntrichia ruralis,* and *Encalypta procera,* Bartholomew's Cobble, Massachusetts.

Wet plants, with *Tortella tortuosa*.

AMBLYSTEGIUM Small stringy mosses with untoothed ovate-lanceolate leaves with short cells, strong costas, and undifferentiated alar cells.

Amblystegium varium

Small, reasonably common mosses making thin mats on tree bark, dead wood, and rocks. Capsules curved, fairly long. Distinctive under the microscope, similar to other stringies (*Hygroamblystegium, Homomallium, Platygyrium, Platydictya, Pylaisia*) in the field. The strong costas separate them from everything but *Hygroamblystegium* (even stronger costas) but are hard to see with a lens. We have two species, both common and weedy. The costa of *varium* extends into the tip; the costa of *serpens* doesn't.



varium *serpens*

Trees, dead wood, limy rocks

Low flat mats

C

Common in right habitat

Microscope needed

Plants small and stringy, capsules curved, fairly long, with whitish peristome teeth. A few plants of *Homomallium* are mixed in.

Amblystegium serpens (slender dark plants with capsules) and *Homomallium adnatum* (larger plants with brushes of bright-green leaves at the tips of the branches) on a limy rock. The two often grow together on rocks that are too dry for *Anomodon*. *Homomallium* is bigger and shinier, but not always separable in the field.

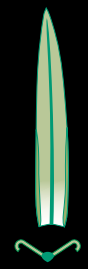
Amblystegium varium (slender stringy plants) and *Homomallium adnatum* (larger plants with brushes of bright-green leaves at the tips of the branches) on a limy boulder.

AMPHIDIUM MOUGEOTII Dense cushions hanging off wet limy rocks; cells with faint, elongated papillae that cross the cell walls.

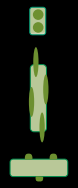
We have two species, *lapponicum* and *mougeotii*. One or the other occurs frequently, often in large masses, on rocks with limy seepage, especially in river gorges. *Hymenostylium* and *Plagiopus* look quite similar and can grow with it. *Hymenostylium* is often smaller, doesn't have the thatch of old leaves, and has papillae over the cell cavity rather than crossing the walls and a needle tip to the leaves. *Plagiopus* has papillae like *Amphidium* but leaves with long, toothed points, and often red stems.

C

Common in right habitat



lanceolate, recurved



papillae cross cell walls

erect, partly immersed

Calcareous seepage

Large cushions

Mossicle

Plants in tense tufts, with a thatch of several years of old leaves at their base; the upper cells have low elongated ridges or papillae that cross the cell walls. The related species *lapponicum* has elongated papillae on the lower cells and round ones on the upper cells.

Microscope needed

Arching, lanceolate leaves, points relatively short.

ANACAMPTODON SPLACHNOIDES Small dark shiny moss growing in dense cushions in crotches and knotholes in trees; capsules constricted below the mouth, peristome teeth flaring or reflexed when dry.

A small moss that forms cushions in recesses in trees, often fairly high above the ground. Leaves oval, costate, untoothed, generally like *Amblystegium* (which is more of a creeper and usually not shiny), but with erect capsules that are constricted under the mouth when dry and have spreading or reflexed peristome teeth.

Trees

Small cushions

U Uncommon

F Identifiable in field

Dense, dark-green cushions in cracks, crotches, knotholes; capsules often abundant.

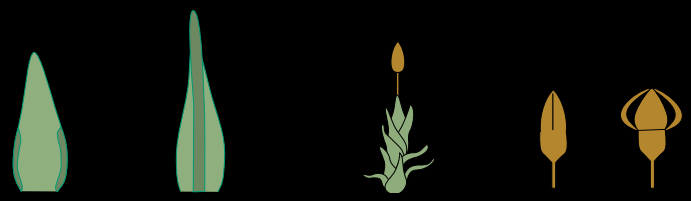
Erect capsules, constricted below the reflexed peristomes.

Erect shoot, ovate leaves with slender tips, reflexed peristome teeth.

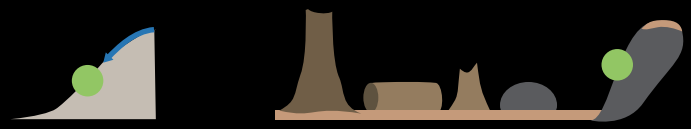
ANDREAEA Small, dark mosses with incurved, concave leaves, thick-walled cells, and capsules opening by vertical slits.

Andreaea rupestris

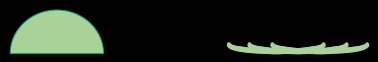
Small, dark, common mosses, making mounds or mats on rocks, often associated with seepage and often covering large areas. Recognized by the red or black color, small opaque leaves without needle points, thick-walled cells, and unique, football-shaped capsules that open by slits.



A. rupestris *A. rothii* small plants, short leaves oval capsules, opening by slits



Wet ledge Forest interior



Small cushions Low flat mat

D Locally dominant

M Must know

ANDREAEA ROTHII Leaves with costas.

slender, elongate leaf tips

Common on rocks and cliffs, often near water or where there is seepage, variously in tufts or mats, often over large areas. Leaves with long tips filled with the costa. Common throughout the eastern NFR.

strong costa, leaves two-layered along edges

angular, porose, thick-walled cells, with small papillae below

Rocks by water

Seepy ledge

Low flat mat

Small cushions

D

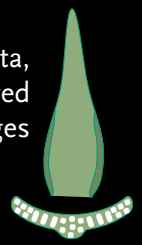
Locally dominant

Microscope needed

Oval capsules, opening by four slits, shortening when dry.

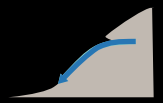
ANDREAEA RUPESTRIS Leaves without costas.

Common on rocks, especially where there is some seepage, variously in tufts or mats, often over large areas. Short, stiff-looking, incurved leaves that spread when wet. One of the few acrocarps without a costa. Pictures have been brightened to show details.



no costa, two-layered along edges

angular, porose, thick-walled cells, with small papillae below



Seepy ledge

Alpine zone

Small cushions

D

Locally dominant

Microscope needed

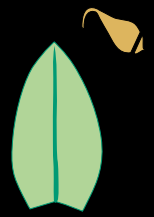
Spreading, concave leaves with relatively short tips.

ANOMOBRYUM JULACEUM Small plants with shiny, cylindrical shoots; leaves tightly shingled, with slender upper cells and enlarged lower ones.

An uncommon or rare moss of sheltered recesses on cold, wet cliffs, usually associated with limy seepage and growing as scattered plants among other species. Shiny, cylindrical shoots with tapered points; oval leaves without teeth, acuminate points, or borders; upper cells long and slender, lower ones short and thin walled.

Two other cylindrical species, the common *Bryum argenteum* and the rare *Plagiobryum zieri*, have wider cells, with larger, usually clear cells above and smaller green cells below. *Bryum argenteum*, in addition, has long acuminate leaf tips.

Lejunea cavifolia



long, skinny cells

Anomobryum

Calcareous seepage

Scattered

U

Uncommon

Microscope needed

Shiny tapering shoots, closely overlapping leaves, sparse clumps. The liverwort is *Lejeunea cavifolia*.

The shoots often taper, the leaves have at most short tips.

ANOMODON Stringy branches, broad, often rounded leaves, multipapillose cells, irregular branching.

attenuatus

F

Identifiable in field

rostratus

F

Identifiable in field

viticulosus

F

Identifiable in field

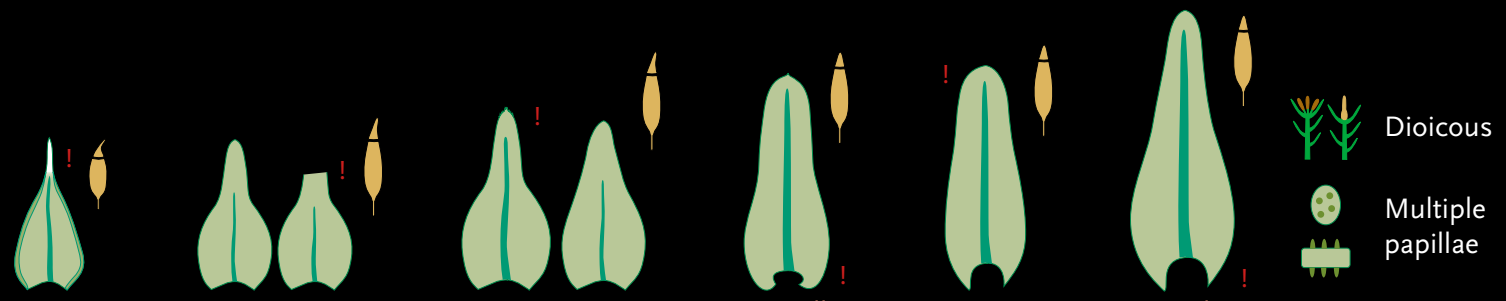
rugellii

minor

F

Identifiable in field

Microscope helps



A.rostratus Rocks

A. triste Trees, rocks

A. attenuatus Trees, rocks

A. rugellii Trees, rocks

A. minor Trees

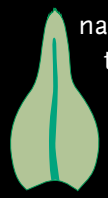
A. viticulosus Rocks

Species in red are common in the proper habitats.

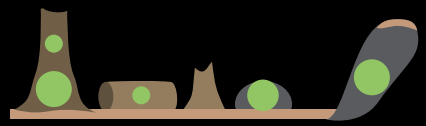
Conspicuous plants of trees, logs, and limy rocks, with irregular branching, stringy shoots, and opaque, papillose leaves. Often recognizable from growth form: *attenuatus* makes a loose thatch; *rostratus* forms dense cushions; *tristis* creeps; and the last three form coat hooks on vertical rocks and trees.

ANOMODON ATTENUATUS Irregularly branched, opaque, forming loose deep mats; some branches slender and elongate, with small leaves near the tips.

Abundant species, a must-know moss. Deep shaggy mats on tree bases, logs, and limy rocks, thinner mats on tree bark. Usually identifiable in field by dull, opaque appearance, stringy growth (dry) with rat-tail and clubbed branches, and rounded triangular leaves with narrowed tips. Often with *Brachythecium*, *Hypnum*, and other Anomodons.



narrowed to tip



Forest interior

Loose thatch

M

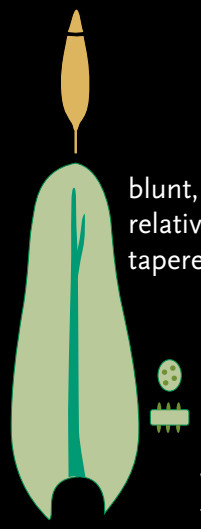
Must know

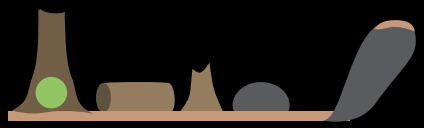
Stringy dry, broad fronds with long leaves wet.

Dull and opaque dry, lots of branches, some clubbed with big leaves, some slender and tapering branches with small leaves.

ANOMODON MINOR Uncommon species of tree bark; blunt-tipped leaves that do not curl when dry, basal lobes rounded, without spiny leaves.

An uncommon species of tree bark, also found on limy rocks. Similar to *rugelii,* our common tree-bark species, but a bit smaller, doesn't curl much when dry, and lacks spiny teeth on the basal lobes of the leaves.





Tree bases in forests

Shingles Coat hooks

U

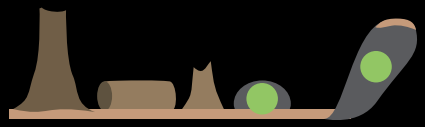
Uncommon

Microscope needed

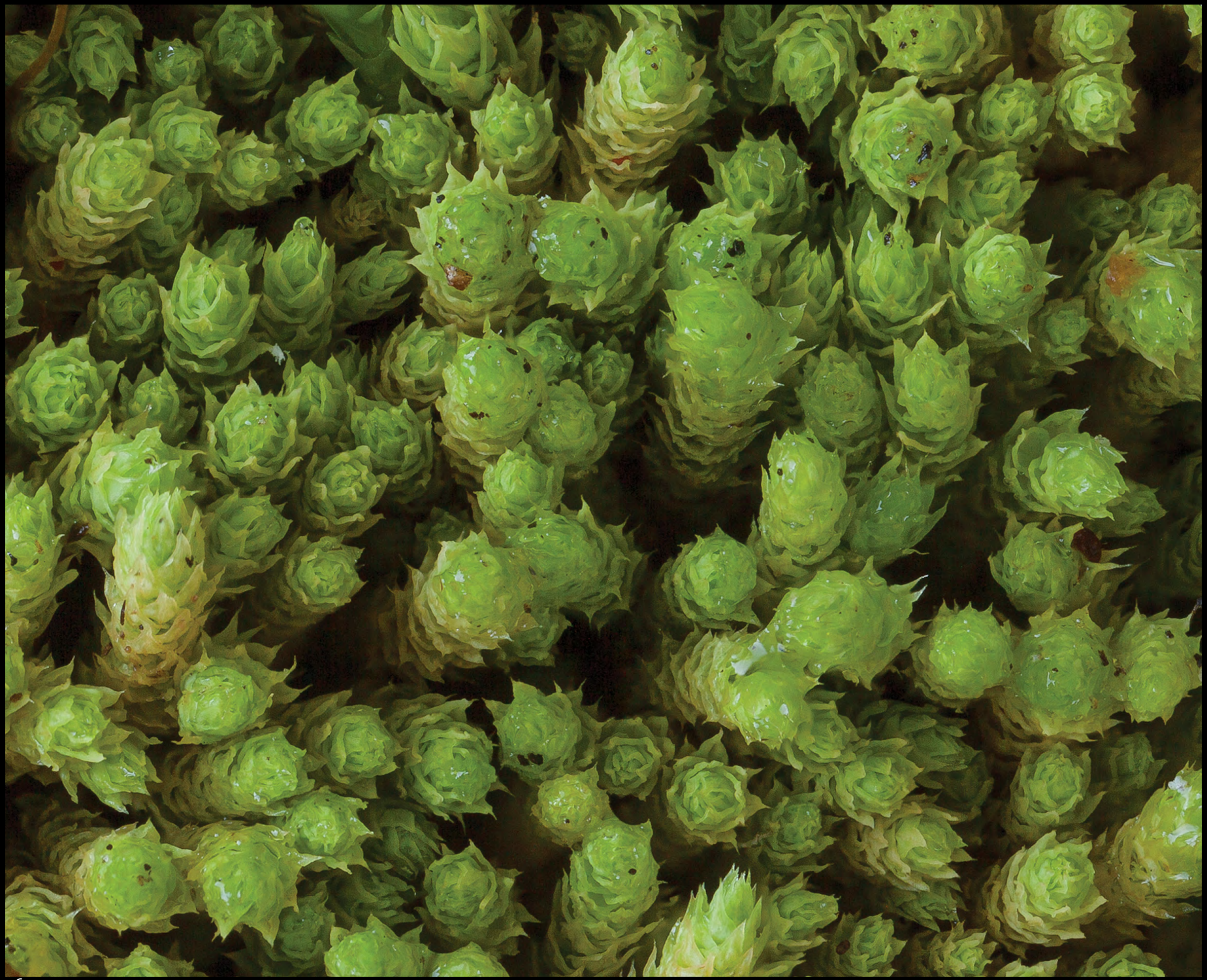
Short, blunt rounded leaves, not curled when dry. Confirm with scope.

ANOMODON ROSTRATUS Dense, light-green mats of slender erect shoots, leaves with white needle tips.

Common species of calcareous boulders and ledges, usually in moist or protected places, often low down or under overhangs. Dense mats of short erect branches when well-developed, creeping when poorly developed. Leaves tiny, opaque, rounded triangular with short white needle tips. Often with other *Anomodons*.



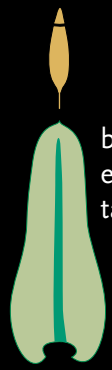
On the base of a rock. Cylindrical branches and light opaque yellow-green color are characteristic.

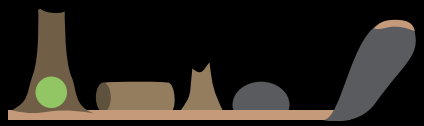


Cylindrical branches, tightly-overlapping leaves, short needle tips.

ANOMODON RUGELII Large, shaggy, sparsely branched; blunt oblong leaves with rounded basal lobes fringed by spiny teeth.

Frequent and locally common on the bases of deciduous trees, also on limy boulders and ledges. Relatively large species, coarse and stringy but not much branched, often curved outward, forming shingles or thick mats. Leaves oblong, rounded, somewhat tapered, with lobes with spiny teeth at the base. Often grows with *Anomodon attenuatus. A. minor* (less tapered, not curled when dry) and *A. viticulosus* (strongly tapered, curled when dry, slender decurrencies at base, grows on rock) are similar and best distinguished with a microscope. But if you see a large shaggy *Anomodon* on a tree base, it is likely this.





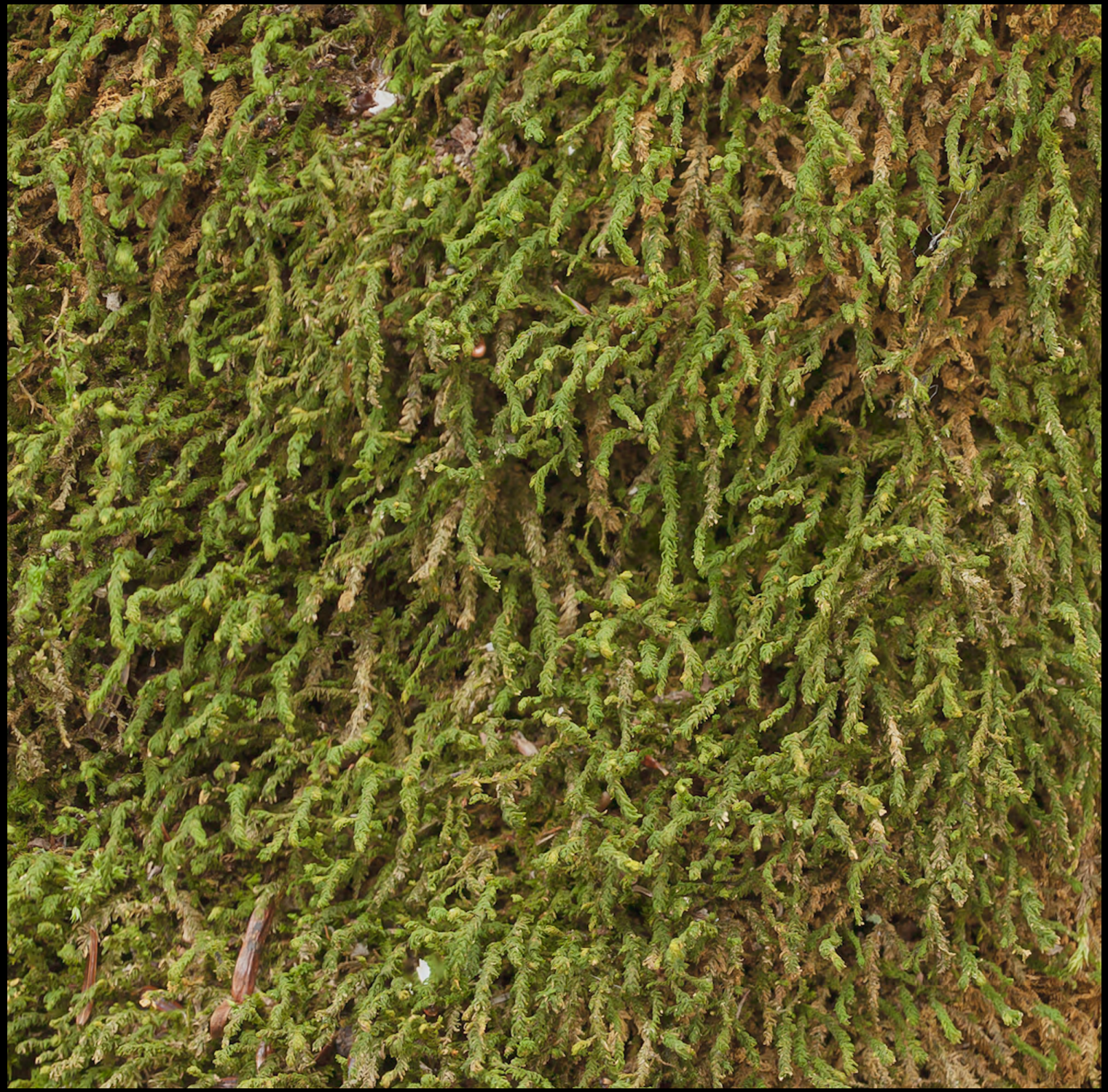
Forest interior

Shingles

C

Common in right habitat

Microscope needed

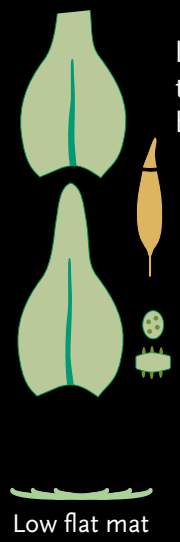


Stringy, dull-green branches.

Oblong opaque leaves tapering to rounded tips.

ANOMODON TRISTE A small species resembling a tiny *Anomodon attenuatus*; leaves under 1 mm long, the lower ones often with their tips broken off; costa covered with papillose cells on the upper side.

A small moss making thin stringy mats on trees or, rarely, on rocks. Recognized in the field, when recognized at all, by the small leaves and the broken-off tips of the lower leaves. Confirmed in the lab by the papillose cells covering the costa on the upper side of the leaf.



F Identifiable in field

U Uncommon

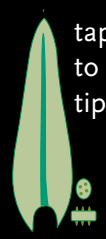
Microscope needed

Small, opaque when dry, leaves oval at the base and narrowed to their tips, under 1 mm long; may have broken leaf tips (this specimen only had a few).

Small opaque leaves; a few leaves with broken tips.

ANOMODON VITICULOSUS Coarse stringy plants on limy rocks, leaves with decurrent bases and relatively narrow tips.

The common *Anomodon* of limy rocks, almost always growing with *Anomodon attenuatus* and *rostratus*. A large, sparsely branched plant making loose mats or fringes with coat-hook branches. Very similar to *A. rugellii*, which typically grows on trees but may grow on rocks. *Viticulosus* lacks the rounded, spiny-toothed lobes of *rugellii*, and has decurrent leaves with a somewhat narrower apex.



tapering to pointed tip

Calcareous rocks or soil

Loose thatch

Shingles

C

Common in right habitat

Microscope needed

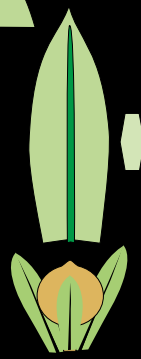
Coarse mats, stringy, coat-hook branches; the common large *Anomodon* on calcareous rocks.

A fringe hanging off a ledge.

APHANORRHEGMA SERRATUM Small, short life-cycle moss; capsules surrounded by the leaves, opening on a definite crosswise line, the capsule cells with strongly thickened corners.

A small, reasonably common moss of open moist ground, found in gardens, fields, and on river banks. Leaves oblong oval, translucent, with large cells; not distinguishable from *Funaria, Physcomitrium, or Physcomitrella*. Capsules are immersed and have a clear line of dehiscence and cells with thickened corners. The capsules of *Physcomitrella* split irregularly; those of the rare *Physcomitrium immersum* lack the thickened corners.

capsule opens on a line



capsule surrounded by leaves

Scattered

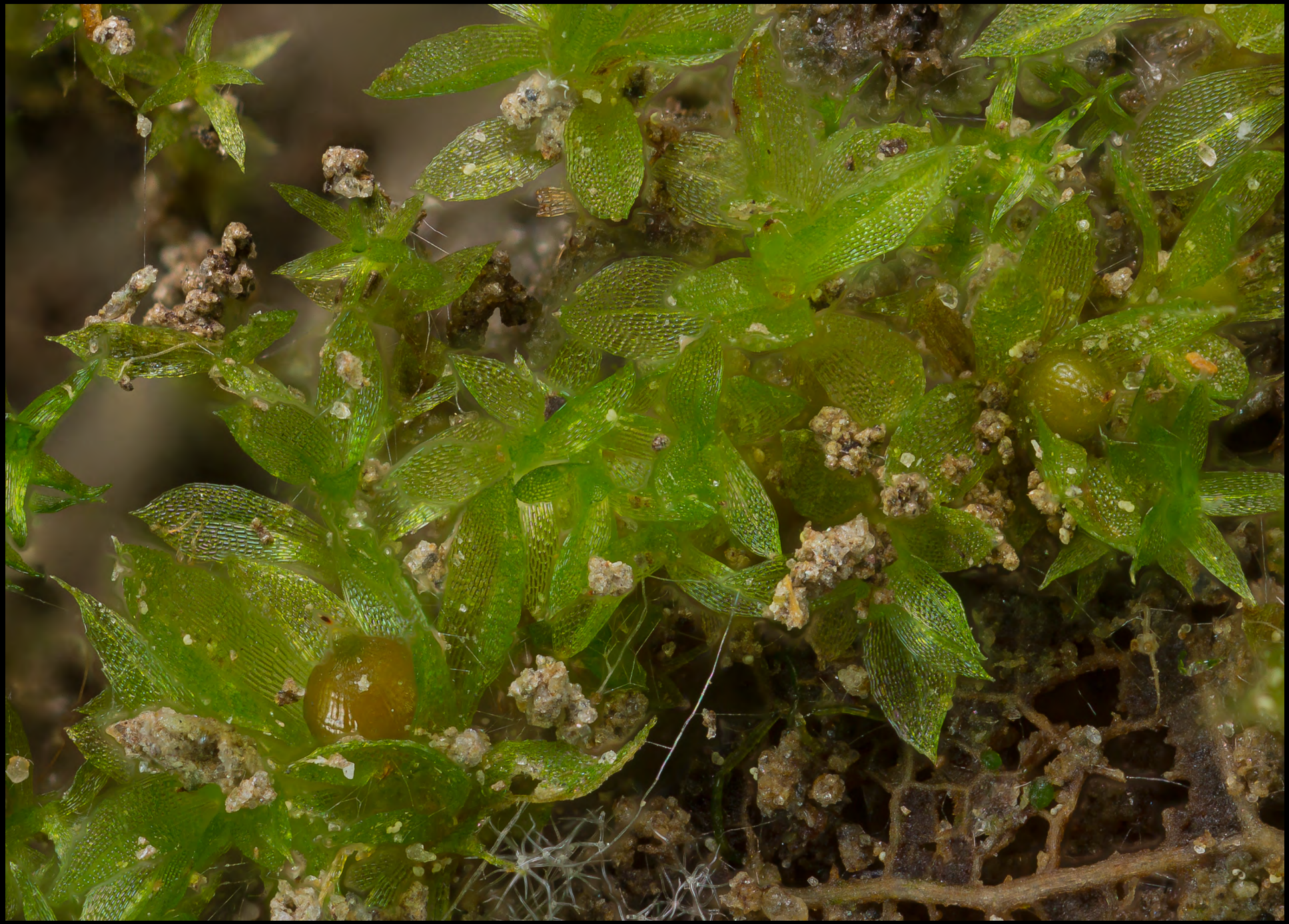
Open soil

C

Common in right habitat

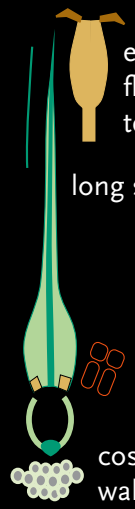
Microscope needed

Leaves with large cells, capsules almost stalkless, with short beaks.



ARCTOA Small wispy mosses of high elevations, similar to *Dicranella* and *Cynodontium* in the field; alar cells inflated and red; costa without stereids.

Small northern mosses found in crevices in the alpine zone, resembling *Dicranella* in their slender-tipped leaves, *Dicranum* in their enlarged red alar cells, and differing from both of these in the costas that lack bands of thick-walled "stereid" cells. Identifiably in the field only if they have capsules, which they usually don't. We have two species, *blyttii* and *fulvella*. My guess is that the pictures are *fulvella*, but I am not sure.

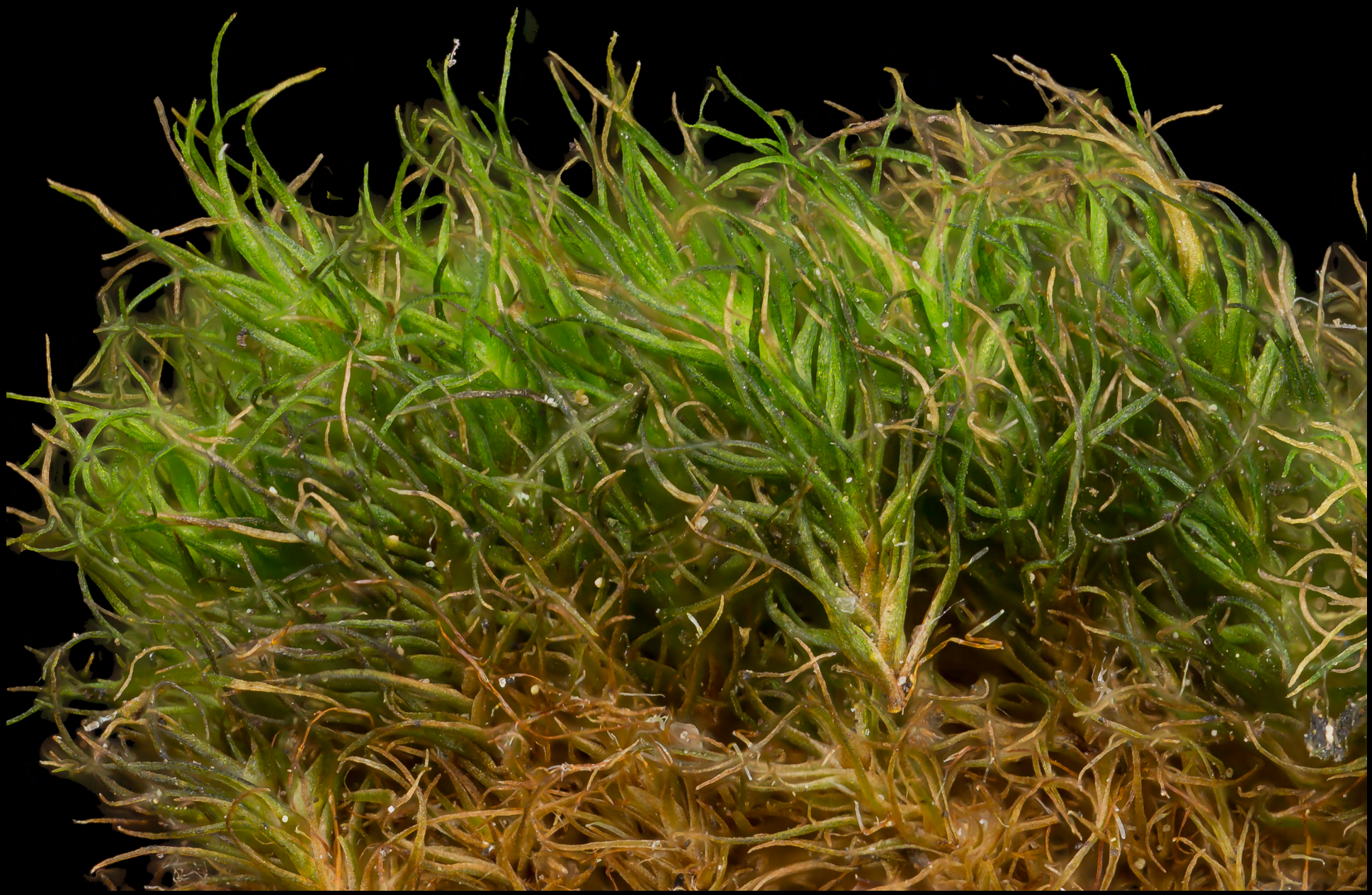


Alpine zone

Small cushions

Rare

Microscope needed



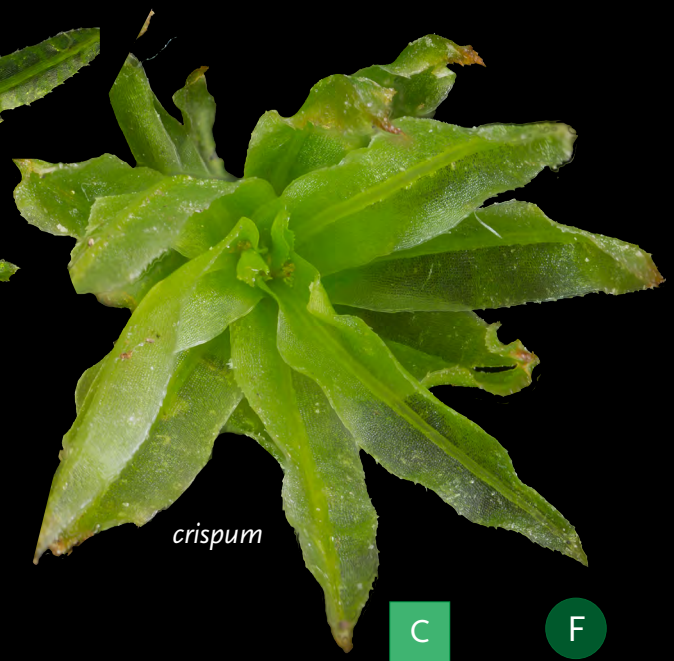
Dense cushion, slender leaves with long inrolled tips, curved when wet, curly when dry. *Dicranella heteromalla* looks the same and grows in the same habitats.

ATRICHUM Soft, often wavy, strongly toothed leaves with lamellae (vertical, photosynthetic ridges) on the midrib.

undulatum group

M

Must know



crispum

C

Common in right habitat

F

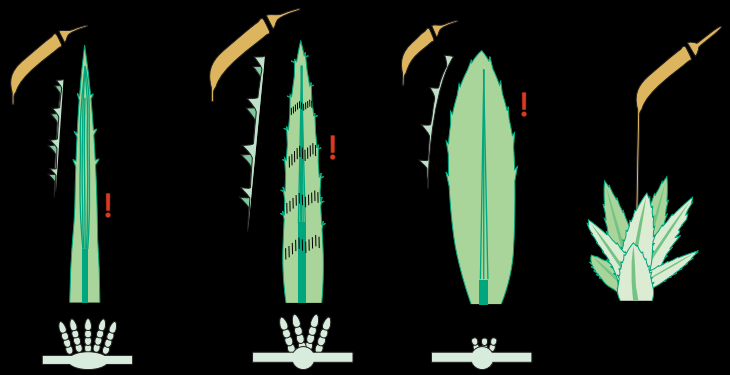
Identifiable in field

angustatum

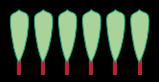
M

Must know

All three species are common in the proper habitats. *Angustatum* is usually on disturbed soil, tip-up mounds in forests, and thin soil over rocks. *Undulatum* and its relatives are abundant on moist shaded soil in many different situations. *Crispum* is principally a wetland species, found on wet sunny shores, often on wood.



angustatum *altecristatum* *crispum*



Groves

ATRICHUM ANGUSTATUM Small species, slender leaves that are toothed only in upper third, typically with tall, wavy lamellae that nearly fill the extreme tip.

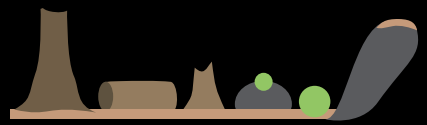
Common species of disturbed mineral soil, often in the open or on the tops of tip-up mounds or rocks. Identified by the double teeth on the edges, teeth on the leaf surface, and narrow leaves with relatively tall lamellae that cover about a third of the leaf width in the middle. Small forms of the *undulatum* group are similar; typically they have wider leaves with larger cells, and a smaller proportion of the leaf tip covered by the lamellae. Grows by itself or often with *Dicranella heteromalla*, *Polytrichum*, or *Ditrichum*.

diocous

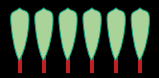
tall lamellae

double teeth

teeth on leaf surface



Forest interior



Groves

Must know

Microscope needed

ATRICHUM ANGUSTATUM Small plants on rocks or disturbed soil, lamellae wavy, filling the relatively slender leaf tip.

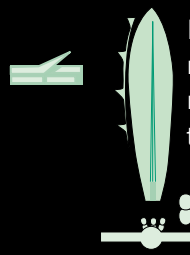
Slender leaves, central band of lamellae (zoom in!) relatively broad with respect to leaf.

Male plants with modified leaves forming cups in which the antheridia (sacs containing sperm) develop.

With *Ditrichum* or *Dicranella* on a shaded mineral-soil bank in oak woods.

ATRICHUM CRISPUM Relatively broad-leaved, not wavy or toothed on surface, lamellae low and inconspicuous.

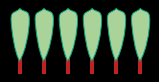
Frequent and locally abundant on wet open soil, especially pond shores, also reported from ledges, ditches, and seeps, and regular on old weathered beaver lodges. Less wavy and broader-leaved than the *altecristatum* group, and with low, inconspicuous, discontinuous lamellae. Confirmed by contrast between large cells near costa and small ones at margins.



Broad leaves, not wavy, mostly single teeth

low, discontinuous lamellae

Open wetland



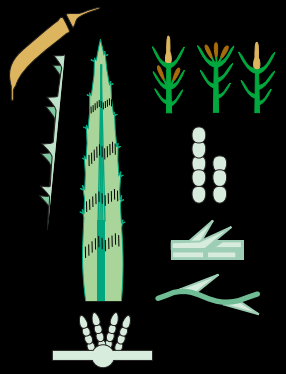
Groves

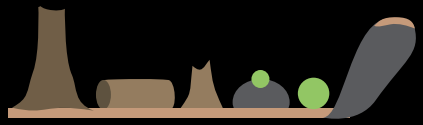
Microscope needed

Low inconspicuous lamellae, only weakly undulate, small single teeth that are often papillose under scope.

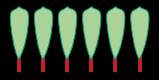
ATRICHUM UNDULATUM GROUP Large plants with conspicuously wavy leaves that are toothed to the middle or below; lamellae not very wavy, slender compared to the width of tip.

Three closely related species, *A. altecristatum, A. crispulum (= oerstedianum)* and *A. undulatum*. Common plants of moist, usually shaded, mineral soils, growing in tall groves, often large and conspicuous. Identified to group by the thin, sharply toothed, wavy leaves with a central band of lamellae that is narrow with respect to the leaf. The species within the group must be identified microscopically, if at all. The group is common in moist deciduous woods, often forming bands along brooks, there often with *Climacium,* or in moist hollows.





Forest interior



Groves

Must know

Microscope needed

April 2020: fruiting plants with old capsules. Capsules elongate, straight to curved, peristome of 32 teeth attached to a drum-like membrane.

Wavy leaves, coarse teeth, plants often large, costa slender at tip

Large plants, with *Climacium dendroides*, on the forest floor in moist second-growth.

Large plants, with *Pohlia annotina*, on the floor of a moist gravel pit.

AULACOMNIUM Large or mid-size, light-colored, broadly lanceolate, toothed leaves, often with gemmae; cells round, smooth or papillose; capsules long, curved, ridged when dry; peristome double.

androgynum

U

Uncommon

F

Identifiable in field

heterostichum

C

Common in right habitat

F

Identifiable in field

palustre

C

Common in right habitat

F

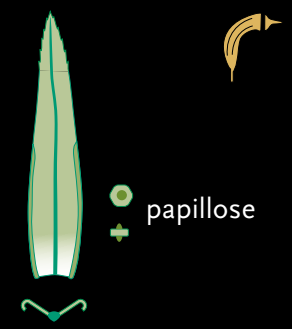
Identifiable in field

Three widely distributed species in the Northern Forest region, plus a rare northerner not shown here.

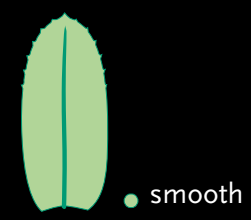
Androgynum is a small species, mostly under 2 cm high, of moist seepy organic soils, wet ledges, and rotting wood. The gemmae are spindle shaped and only at the tip of the stalk.

Palustre is a large, common species of wetlands, often growing in bright yellow-green clumps. Its gemmae are triangular or oval, and on both the tip and sides of the stalk.

Heterostichum is a medium-sized species of soil banks in the oak zone, with broad, coarsely toothed leaves and short stems. It looks very full and leafy in the spring.

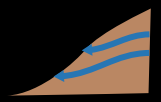


androgynum, palustre



heterostichum

Open wetland

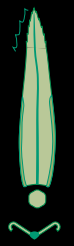


Seepy bank

Tree bases

AULACOMNIUM ANDROGYNUM Small green or silver-green plants, with tiny gemmae in balls at the tips of stalks.

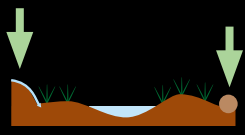
Androgynum is a small species of pools and seeps, frequent along the Atlantic coast, uncommon or rare inland. Its best field marks are the slender, silver-green leaves and gemmae in balls at the tips of stalks.



lanceolate, toothed

papillose

gemmae at tip



wet soil, often in seepage

Open wetland

wet, rotting wood

Thin doormat

Tufts

F

Identifiable in field

U

Uncommon

AULACOMNIUM HETEROSTICHUM Broad-leaved species with blunt yellow-green leaves with conspicuous teeth, found in open woods.

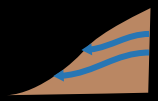
Heterostichum is a conspicuous, patch-forming species found on moist shaded banks, stream banks, and tree bases, mostly in the oak zone. The plants are yellow-green, the shoots somewhat flattened, the leaves broad, blunt, conspicuously toothed, and somewhat ripply. Nothing else like it.

smooth

heterostichum

Large cushions

Tree bases



Seepy bank

F

Identifiable in field

M

Must know

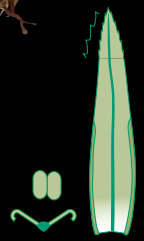
Broad blunt toothy leaves, long curved capsules, ridged when dry.

With *Bartramia pomiformis* (skinny leaves, round capsules); leaves slightly ripply, young shoots look like cabbages.

On a seepy mineral-soil bank in oak woods; with Bartramia.

AULACOMNIUM PALUSTRE Large plants, often in hummocks among grasses or sedges in wetlands, also in seepage over rocks.

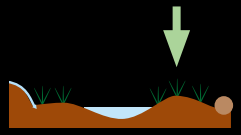
yellow-green, leaves curled when dry, in dense mats or cushions


lanceolate, toothed

papillose

gemmae on sides & tip

dioicous


Hummocks in wetland

Thick doormat

Must know

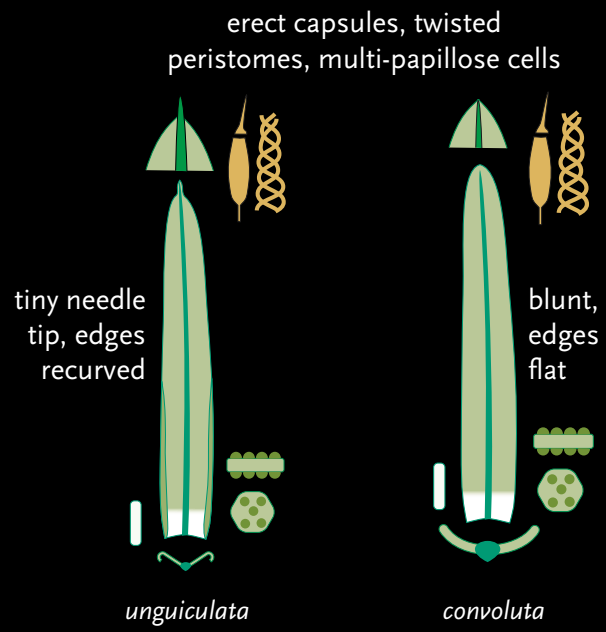
Young shoots sprouting from matted old stems, in a hemlock swamp.

BARBULA Small opaque yellow-green papillose mosses with straplike leaves and erect capsules; peristome teeth long, slender, twisted.

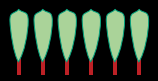
unguiculata

convoluta

A small moss of disturbed soil and limy rocks, with yellowish, parallel-sided leaves, erect capsules with long beaks and twisted peristomes, and cells with small, sharply-defined papillae. We have two species, which can usually be identified in the field. *Unguiculata*, with tiny needle tips on the leaves, recurved edges, and some red in the setae, is common and weedy. *Convoluta*, with rounded tips, flat edges, and yellow setae, is widespread but less common. They are close, and a check with a microscope is advised.



Calcareous rocks or soil



Groves

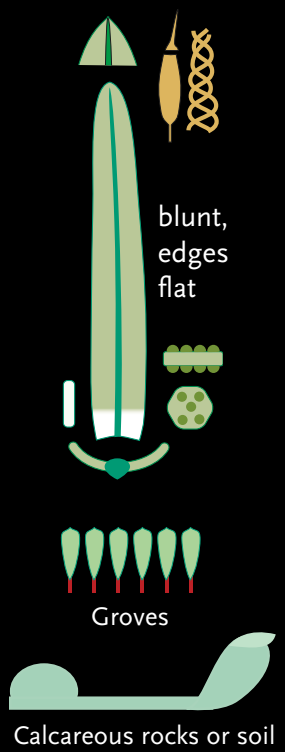
F Identifiable in field

C Common in right habitat

Microscope needed

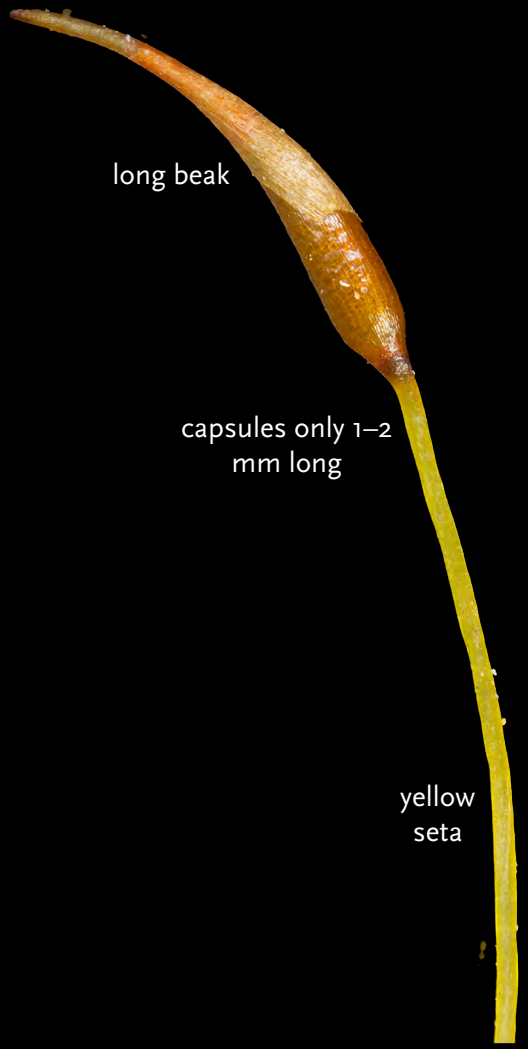
BARBULA CONVOLUTA Small, opaque, papillose moss with rounded, often obtuse leaves.

A small, yellowish Potty—member of the Pottiaceae—with blunt, somewhat parallel-sided leaves, forming low but often dense mats on limy rock or disturbed limy soil. Cells multipapillose, margins flat, long cells exposed on both surfaces of costa. *Barbula unguiculata* is similar, more weedy, and has a needle tip to the leaves. *Weissia*, also weedy, has inrolled leaf edges.



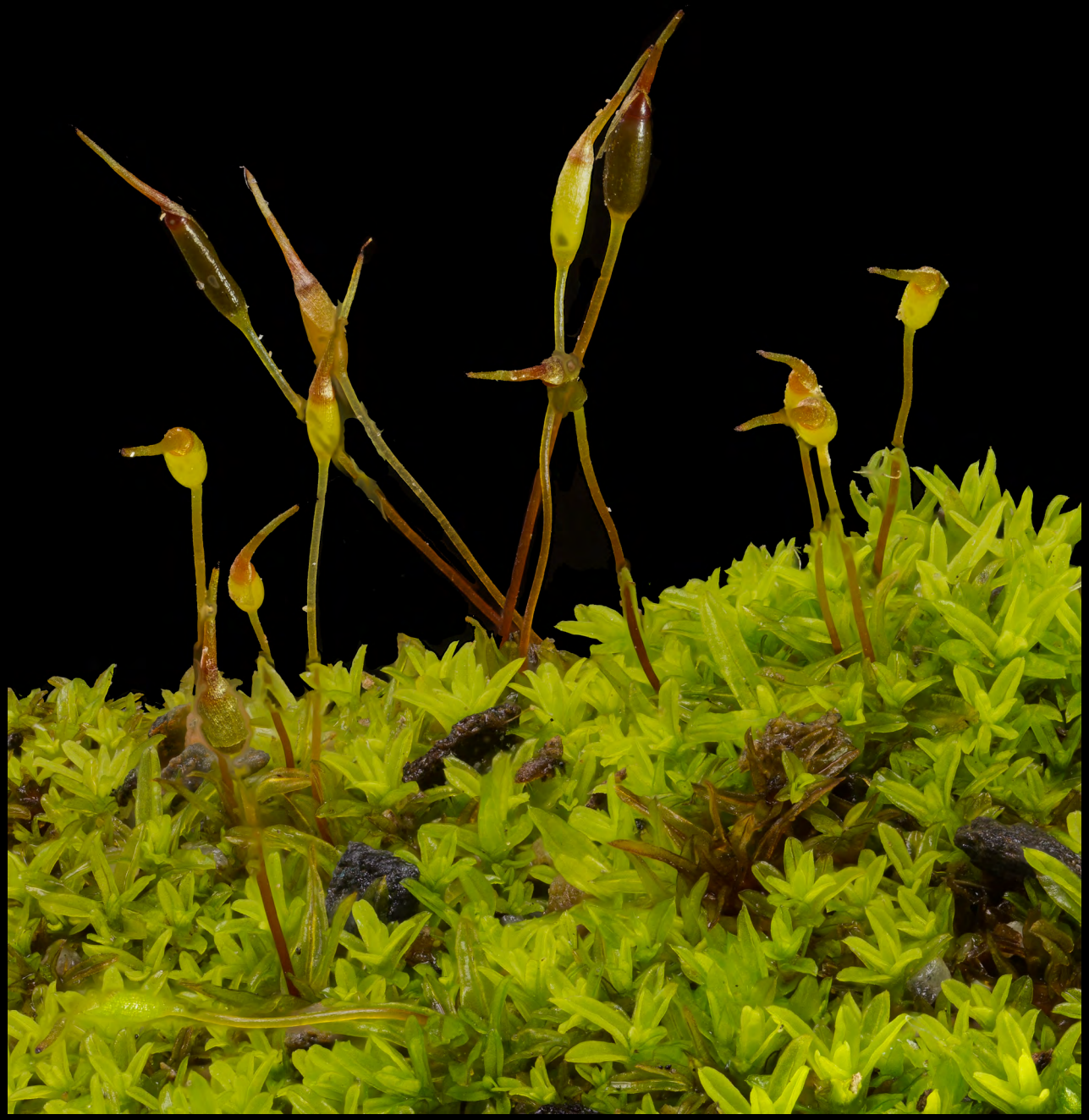
Uncommon

Microscope needed

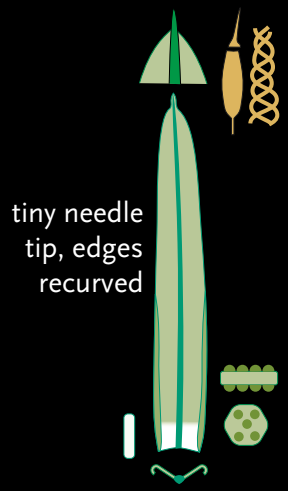


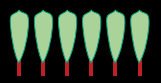
Leaves opaque, with flat edges and blunt points.

BARBULA UNGUICULATA Small opaque yellow-green papillose moss with straplike leaves with small needle tips.



The commoner and weedier of our two Barbulas, distinguished from *convoluta* by the tiny needle tips and recurved edges of the leaves and the reddish setae. Common in open, disturbed soil, burns, road edges, and on limy ledges.





Groves

Calcareous rocks or soil

C

Common in right habitat

Microscope needed

Tiny needle tips, edges rolled under; neither easy to see; the microscope helps.

In gravel at the edge of a driveway. The desk I am writing on was built here.

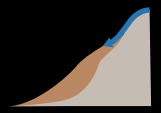
BARTRAMIA POMIFORMIS Light-green, slender-leaved moss with round capsules, in open cushions on moist rocks.

A common species of moist seepy rocks, usually where the water (though not necessarily the soil) is calcareous. Pale bright green, with long leaf tips, forming open cushions and mossicles, also sometimes mats. Small, round capsules common.

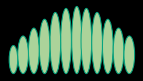
slender leaves, double teeth

papillose

monoicous, round capsules



Dirty wet ledges



Loose mounds

M

Must know

Slender, long-pointed leaves, curled up when dry, lots of teeth, round capsules.

April, 2020; new capsules and leaves from the top of last year's growth.

Loose cushion, light bright green, round capsules.

Small, round, light green capsules, curly leaves.

Slender, toothed, leaf tips.

A thin mat in seepage.

Curled when dry.

BAZZANIA TRILOBATA Large, dark-green liverwort with forking stems and shingled leaves with three small teeth at tip.

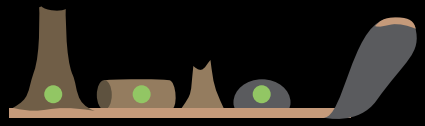
Dicranum montanum

An abundant species of moist conifer forests, forming large mats over soil, rocks, logs, and tree bases. It is a coverall species, preferring raised, sloping or vertical surfaces but not otherwise fussy about substrate. The largest liverwort on the boreal forest floor, and easily recognized by the trapezoidal leaves with three small teeth on the outer edge.

large, dark-olive, looks shingled

stem leaves

underleaf



Forest interior

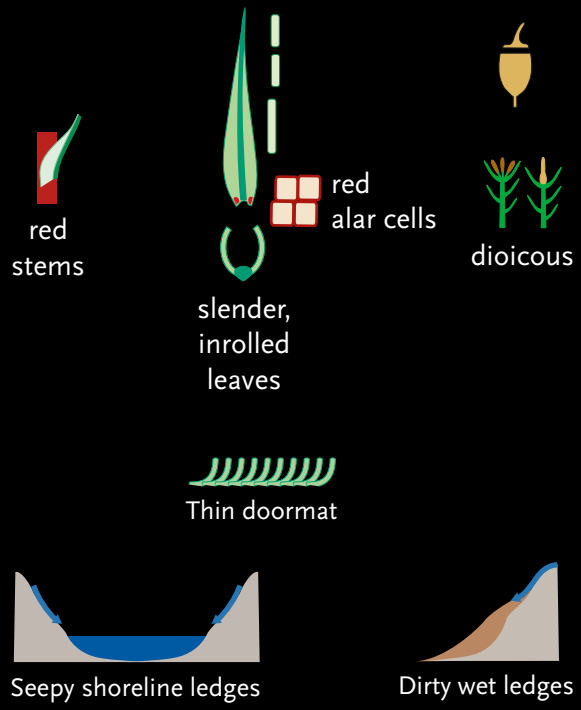
Loose thatch

Must know

Large continuous carpets over mounds and open soil, often associated with other coveralls: *Hypnum, Pleurozium, Ptilium,* and *Hylocomium.*

BLINDIA ACUTA Dark, wiry moss on wet ledges or in the splash zone; slender leaves, enlarged red alar cells.

A small, dark, stringy moss found on wet rocks with limy seepage or in the spray zone of brooks. Often recognizable in the field by the red stems and slender inrolled leaves. Lab characters are the absence of teeth, relatively slender cells, and red, thick-walled alar cells.



Microscope needed

Slender, inrolled leaves, often curved; red stems.

A low, dense, turf, growing on calcareous soil impacted by ice-fall, below a subalpine ledge.

BRACHYTHECIUM Soft, pale green, costate leaves with long tips; loosely pinnate branching; short, inclined capsules; loose, irregularly branched mats.

campestre

Common mosses of moist woods and thickets, found on rocks, soil, wood, and trees. Recognizable in the field, with experience, by the light color, slender-tipped costate leaves that may be pleated, irregular branching, and short chubby inclined capsules. Some species are identifiable, again with experience, in the field. Confirmation requires a microscope. Capsules help a lot; get them if you can.

We treat the eight commonest species here. They divide, loosely, into three ecostructural groups with two outliers.

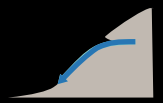
Campestre and *laetum:* big species with smooth setae and pleated leaves on logs, tree bases, and ledges.

Rutabulum and *rivulare,* big species with smooth leaves and rough setae, on wet wood, soil, or ledges.

Reflexum and *populeum,* small or medium species of rocks tree bases, and logs in which the costa extends into the leaf tip and the seta is papillose, at least above.

Plumosum, typically on rocks in brooks, with small alar cells, the costa not reaching the tip, and the seta rough above and smooth below.

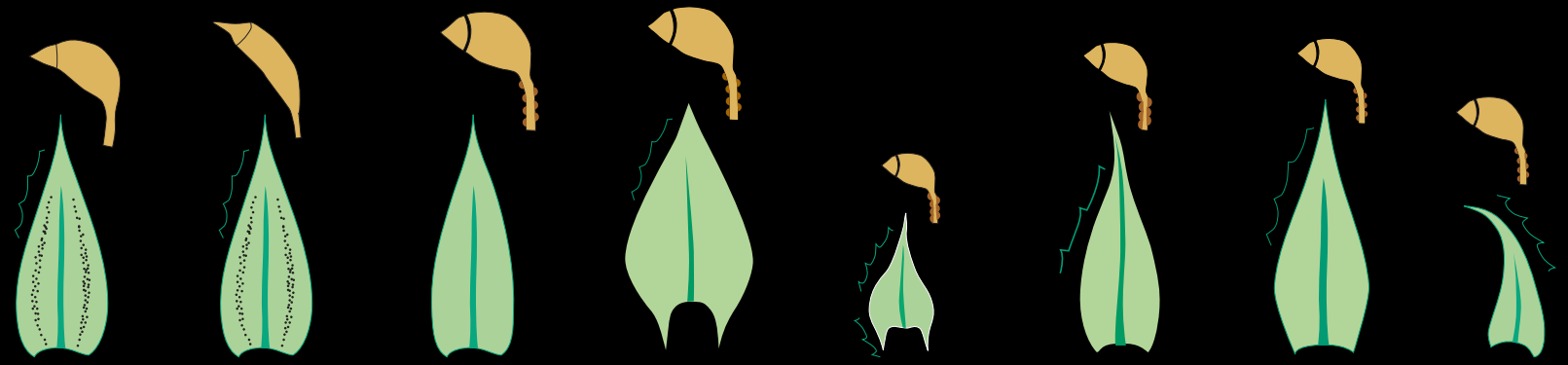
Velutinum, an uncommon or at least less common species of soil ,with slender curved leaves, resembling a small *Hypnum*.



Seepy ledge

Open wetlands

Deciduous forests



campestre *laetum* *rutabulum* *rivulare* *reflexum* *populeum* *plumosum* *velutinum*

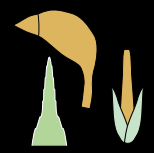
The papillae on the seta, which occur in all species except *campestre* and *laetum*, look like small rough dots in our photos, and can often be seen with a 20-power lens.

Must know

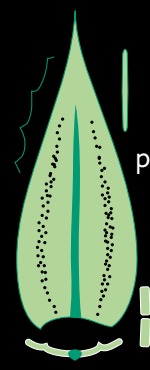
Microscope needed

BRACHYTHECIUM CAMPESTRE Large species, common on logs, soil and tree bases, fruiting plentifully; pleated leaves with large inflated alar cells; setae smooth.

Formerly *salebrosum* in books; still that in our hearts. Large, common and widely distributed. A large *Brachythecium* with pleated leaves and abundant capsules is likely this species.

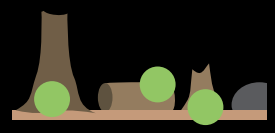


smooth setae



pleated leaves

abruptly enlarged alar cells



Logs, tree bases, stumps in moist shade

Loose thatch

D

Locally dominant

Microscope needed

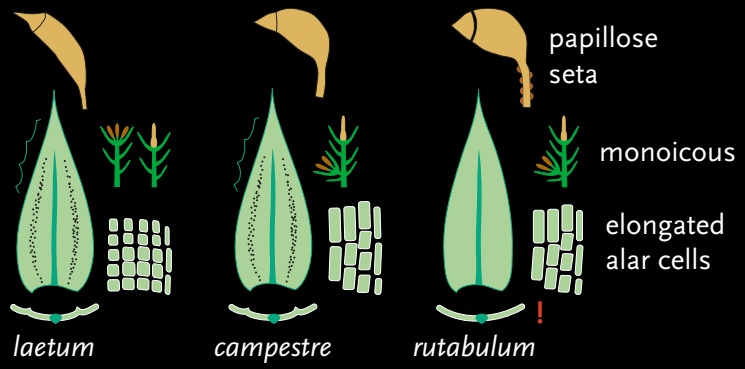
Often mixed with other mosses in loose mats on tree bases and logs. Here *campestre* (light, long tips, loosely pinnate) is overgrowing *Hypnum imponens* and *Entodon seductrix*.

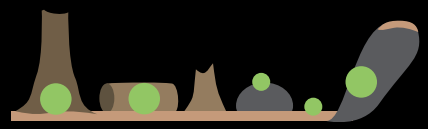
And here with *Hypnum imponens, Entodon seductrix* (somewhat hidden), and *Thuidium delicatulum*. The long straight capsules are *Entodon*.

On a stone in moist deciduous woods, in late winter; irregularly pinnate, in a loose thatch, yellowing after the snow is off. *Rutabulum* and *oxycladon* look much the same.

BRACHYTHECIUM LAETUM Large, irregularly branched, light colored, shiny, in deep loose mats. Leaves plicate, seta smooth (but capsules rare), alar cells gradually inflated.

Brachythecium laetum, *campestre,* and *rutabulum* are three large common mosses growing in loose thin or deep mats, either mixed with other mosses or in pure stands, anywhere near the ground where it is moist. They often cover large areas. As a group they are identified by the relatively large size, pale-green costate leaves with long slender tips, loosely pinnate growth form, and short, inclined capsules. Species identification is based on the pleating of the leaves, size of the alar cells, and presence or absence of papillae on the setae. *Laetum* is found on ledges and trees, often some distance of the ground. It is dioicous and rarely fruits. The capsules, when present at all, are somewhat longer than those of *campestre* and have smooth setae. We identify sterile plants by the gradual transition between small cells in the upper part of the alar region to enlarged ones near the base and by the small cells along the edge of the leaf at the base. *Campestre* has more abruptly enlarged alar cells and larger cells along the basal edges.





Forest interior

Loose thatch

Must know

Microscope needed

Shiny leaves with long tips; costas hard to see; branching irregular. Probably can't be distinguished from other large Brachytheciums at this scale.

Very common, though usually sterile, on the tops of limy boulders and on shelves and moist faces on limy ledges.

With *Anomodon attenuatus,* a common associate, in big, shaggy, loose mats on tree bases. In our experience the relatively stiff and usually sterile mats that grow above the ground on ledges are often *laetum*; those on tree bases are either *campestre* (often fruiting) or *laetum* (usually sterile).

Silky, interwoven, loosely pinnate, light-colored fronds forming a deep mat.

Pleated, ascending, leaves with slender tips. The costas are weak and hard to see without a microscope.

BRACHYTHECIUM PLUMOSUM Dark-green, medium-sized, glossy, often with capsules; costa not extending into the tip; alar cells small, opaque, square; seta rough above, smooth below.

The common *Brachythecium* of rocks in the channels and splash zones of streams, growing higher up than *Hygrohypnum* and *Torrentaria.* In small woodland streams, it often covers large areas on the tops of rocks. Other than by habitat, it is not particularly well marked in the field: dark and glossy, leaves not pleated, smaller than *rutabulum* or *campestre,* with the upper parts of the setae papillose. The critical characters are the small opaque alar cells and the relatively short costa. *Rutabulum* and *rivulare,* both of which like wet places, have larger alar cells; *populeum,* which tends toward the dry, has a costa that extends up into the tip.

Moist rocks in and near streams

Loose thatch

D

Locally dominant

Microscope needed

Glossy long-tipped leaves, clearly *Brachythecium*, but not clearly any particular *Brachythecium*.

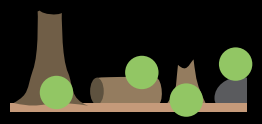
Long, stringy, irregularly branched, leaves often curved to one side. Often grows with *Hygrohypnum* and can resemble it.

Rhizomnium punctatum, Thuidium delicatulum

A large shaggy mat from the upper part of the spray zone, with *Rhizomnium punctatum* and *Thuidium delicatulum*.

BRACHYTHECIUM POPULEUM Light green, stringy, in loose mats; costa enters leaf tip; alar cells small and square; setae papillose above.

A common mid-sized species, most often seen in open thickets or successional walls, often on fairly dry logs or rocks. We guess at it in the field by the light color and stringy growth, and confirm it by the costa that extends into the leaf tip, small square alar cells, and setae that are papillose above. *Reflexum,* which also has a long costa, is smaller, toothed to near the base, and has shorter cells and setae that are papillose throughout.



Logs, tree bases, stumps, stones

Loose thatch

C

Common in right habitat

Microscope needed

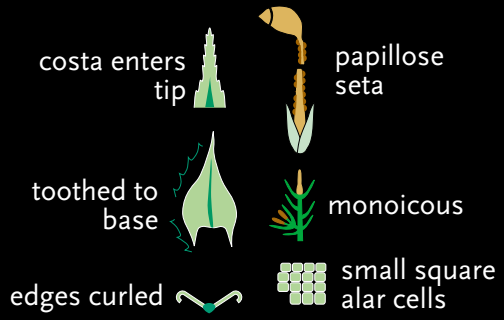
Often yellow-green, looks stringy rather than full, leaves slender, with long tips.

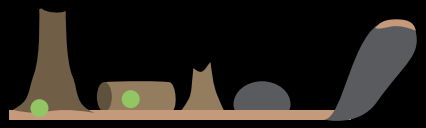
Capsules common; roughness on upper seta can be seen with a 20x lens.

Scruffy Brachytheciums making do on dry rocks in successional woods are often *populeum*.

BRACHYTHECIUM REFLEXUM Small plants with curved branches making loose mats; costa extends into tip, leaves toothed to base.

Small, frequent, somewhat inconspicuous, species most often found in thin, silky-looking patches on moist tree bases, logs, and boulders. Best field characters are the small size, curling branches, long leaf tips, weak costa extending far into the tip, short cells, and short capsules. Easily confused with *Amblystegium varium* and other small costate mosses when the capsules are not present. The branches curl when dry, resembling those of *Pylaisiella,* which does not have a costa. Often found mixed with other common tree-base and log species: Hypnums, Brachytheciums, etc.





Forest interior

Loose thatch

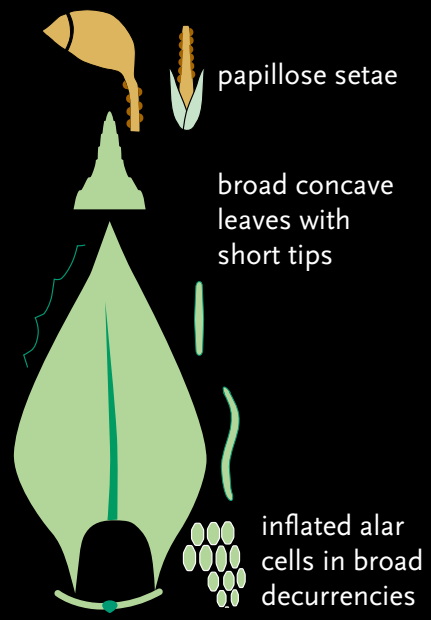
Low flat mat

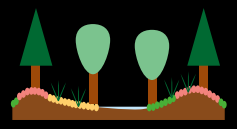
Microscope needed

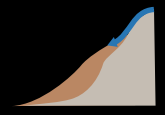
Small, long-pointed leaves, loose mats, long tips.

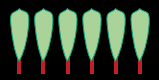
BRACHYTHECIUM RIVULARE Large species, sometimes treelike, with deeply concave leaves with broad decurrencies and short tips.

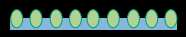
A common species of seeps, pools, swamps, streambanks, and wet ledges. Less evergreen than our other species, tending to produce a dense flush of new growth in the spring. Early growth is unbranched and erect, later growth can be treelike. Often identifiable in the field by the broad concave short-tipped leaves with large decurrencies. Under the microscope the inflated alar cells extend inward to the costa, down into the decurrencies, and bulge outward at the margins. *Rutabulum* can be similar; it is best separated by its more sharply toothed leaves with long acuminate tips.




Swamp


Dirty wet ledges


Groves


Wet mats

F
Identifiable in field

D
Locally dominant

Microscope needed

Young cylindrical shoots in a woodland seep.

Young shoots on a wet shaded ledge, just starting to branch. *Plagiothecium cavifolium* grows in the same sort of places and can look similar when young.

BRACHYTHECIUM RUTABULUM Large species with rough setae and smooth leaves; alar cells inflated and decurrent.

A large common species, similar to *campestre* and sometimes growing with it, often replacing it on wet substrates. Distinguished by the papillose setae, long slender tips, smooth (unpleated) leaves, and enlarged alar cells in decurrencies. *Rivulare*, our third large common *Brachythecium*, can be quite similar, but has broader leaves with short tips and rarely has capsules.

Wet wood and soil in shade

Loose thatch

D

Locally dominant

Microscope needed

Leaves broad, concave, decurrent, long-tipped, without pleats; setae rough.

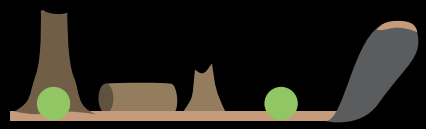
Plants look like lush *campestre*, or *rivulare*, but with narrower leaves with longer tips.

BRACHYTHECIUM VELUTINUM A small species, uncommon and hard to spot, with slender, long-pointed, curved leaves; alar cells small and square; setae papillose to base.

papillae look like small dots

An uncommon or overlooked species, looking a bit like someone had put *Hypnum* leaves on a plant with the color and branching of a *Brachythecium*. The costate leaves separate it from any *Hypnum*, the small size, teeth to base, and long curved points from other Brachytheciums.

leaves curved but don't curl under the way *Hypnum* leaves often do



Tree bases, mineral soil in forests

Loose thatch

U

Uncommon

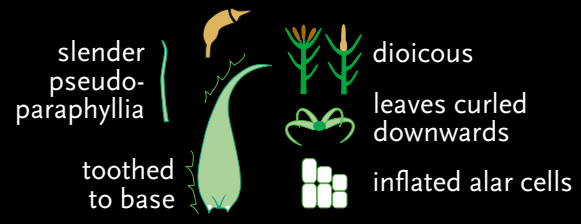
Microscope needed

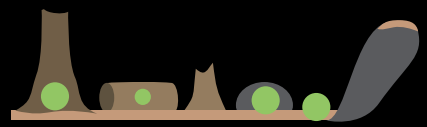
Short capsules with rough setae, curved leaves that spread more than the small Hypnums. With *Bryum capillare* and *Callicladium haldanianum*.

On calcareous soil in dry woods, with *Atrichum angustatum*, *Dicranella cf. heteromalla*, *Fissidens sp.*, and *Haplocladium virginianum*.

BROTHERELLA RECURVANS Pinnate branching, sickle-shaped leaves that are turned under, variegated light and dark green color and general shininess.

A common species growing on or near the ground in moist mixed and conifer forests, but scarce or absent in dryer forests. Strongly resembling, and often growing with, *Hypnum imponens*. In the field they can often be separated by the yellower color, more regularly pinnate branching, and more tightly braided appearance of the leaves of *Hypnum*. Microscopic verification, which we advise, depends on the toothed margins, abruptly inflated alar cells, and slender pseudoparaphyllia of *Brotherella*.





Forest interior

Loose thatch

Low flat mat

C

Common in right habitat

Microscope needed

Pinnate, glossy, often variegated white-green; shoots somewhat flattened; leaves with long tips that curl down.

Loosely pinnate branch-ing, loosely braided leaves, long leaf-tips turned downwards.

Resembles *Hypnum imponens*, but less neat and often greener.

Shiny, rather tight, mottled green mats, close to the ground; common in mixed forest, and among the roots of conifers.

BRYHNIA Leaves with costas, slender tips, and teeth, cells projecting minutely at upper ends.

Small or medium-sized mosses, growing on soil or occasionally logs, with toothed, costate leaves and upper cells with minutely projecting ends. These are hard to see in *novae-angliae*, which is more easily recognized by the broad leaves with twisted tips and enlarged, decurrent alar cells. *Novae-angliae* is a species of moist rocks and soils, with broad leaves with twisted tips. It is usually recognizable in the field. *Graminicolor*, found on shaded limy rocks and soil, is less well marked, and needs the scope for definite identification.

M

Must know

novae-angliae

Loose thatch

broad leaves with twisted tips, alar cells enlarged, in decurrencies

graminicolor

Loose thatch

slender, sharply toothed, very strongly papillose

C

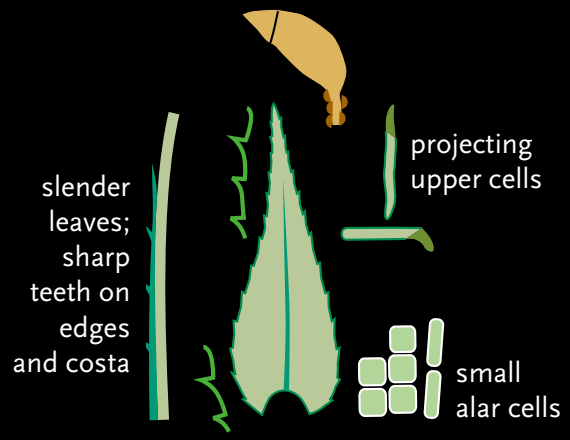
Common in right habitat

Both species are dioicous and have papillose setae

Microscope needed

BRYHNIA GRAMINICOLOR Small, wispy, sparsely branched plants with slender, strongly toothed and strongly papilllose leaves with long skinny tips.

Frequent and locally common on thin limy soil on banks or at the bases or in recesses of limy ledges. Not strongly associated with seepage and may be in fairly dry sites. Resembles an *Amblystegium* or small *Brachythecium* in the field. The microscope helps. The strong teeth and strongly projecting papillae are the definitive characters.



Shaded limy soil

Loose thatches, thin mats

C

Common in right habitat

Microscope needed

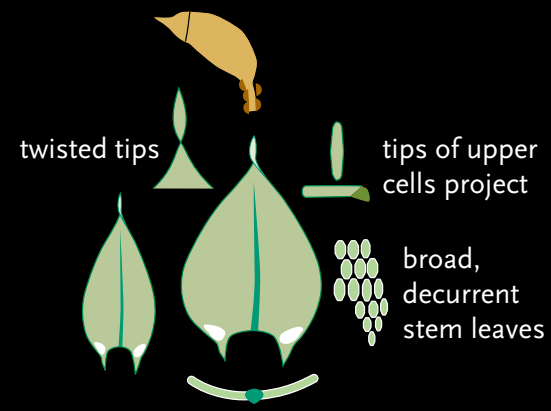
Slender leaves with long tips; often pale green or yellow-green; can look like *Pylaisiadelpha tenuirostris,* which doesn't look like much.

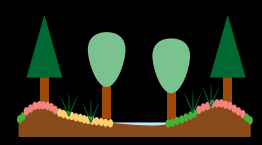
A loose growth form with separated leaves, from below a limy ledge.

A denser growth form, on a limy bank.

BRYHNIA NOVAE-ANGLIAE Highly branched, light white-green, concave, heart-shaped stem leaves with twisted tips.

Common, often dominant species of wet soil, stream banks, seepy ledges. Also occasionally on logs. Recognized in the field by broad oval stem leaves with twisted tips and the narrower branch leaves; the light green color; and, when mature, the somewhat treelike growth form with broad branch angles, resulting in an open-branched canopy. *Brachythecium rivulare* grows in similar places and has a similar growth form but, when mature, is bigger and darker.





Broad-oval stem leaves, narrower branch leaves with twisted tips.

Branches at broad angles, forming a canopy.

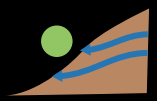
Forms patches from creeping stems; plants treelike, forming a canopy.

BRYOANDERSONIA ILLECEBRA (Giant Worm Moss) Fat cylindrical branches; broadly concave, costate leaves with short, often twisted tips.

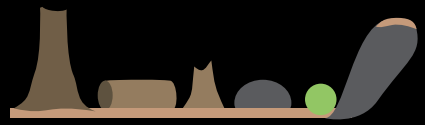
A common moss on seepy, fertile soil in the oak zone, immediately distinguished by the fat, wormlike shoots and broad concave leaves.

cylindrical shoots

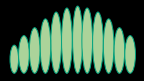
broad, concave leaves



Seepy bank



Forest interior



Loose mounds

C

Common in right habitat

Old plants after winter, just starting to grow.

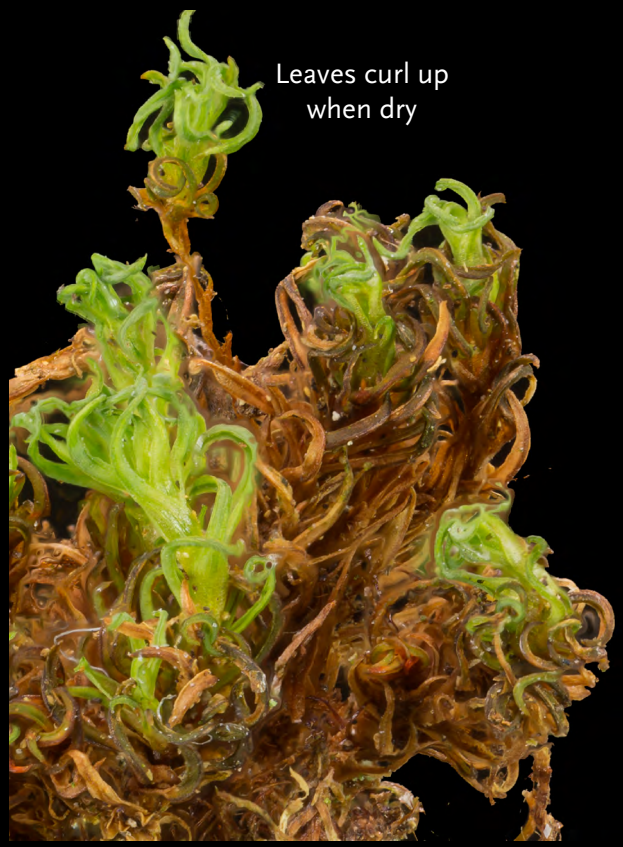
Either in mounds, or thick mats, often among grasses and herbs.

BRYOERYTHROPHYLLUM RECURVIROSTRUM Slender, papillose leaves with sharply recurved edges, old leaves reddish.

A small light-green, papillose moss that grows on wet limy rocks, often by rivers, and sometimes on concrete bridges. The leaves are oblong-lanceolate and have enlarged oblong basal cells, short, multi-papillose upper cells with large, C-shaped papillae, and often a few blunt teeth near the tip. The edges of the leaves are recurved and the bases of older leaves are often reddish, a useful field character. The upper surface of the costa is covered by short cells. The capsules have short peristome teeth, but they often fall off the old capsules.

A member of the Pottiaceae, a difficult group. When the red leaf bases and leaf teeth (large, blunt, irregular) are present it is easy to identify. When they are not, the recurved edges, C-shaped papillae, large basal cells and short cells covering the costa are essential characters.

Hymenostylium recurvirostrum (papillae not C-shaped, costa covered with long cells, old leaves not red) is similar, has the same last name, and often grows with *Bryoerythrophyllum*.



Calcareous seepage

Seepy shoreline ledges

Thin doormat

Small cushions

C
Common in right habitat

Microscope needed

Leaves lanceolate or oblong, papillose, with short points and often a few inconspicuous teeth near the tip, curling when dry.

Loose mats or cushions on moist limy soil; older leaves turn brick red. and persist as a dense thatch.

On limy soil, with *Bryhnia graminicolor* and *Mnium cf. thomsonii.* New shoots growing from a reddish thatch of older ones.

BRYUM Small or medium-sized; oval untoothed leaves with borders of long cells; capsule nodding, with a neck below the spore chamber.

Small, common, often weedy mosses growing in mats or cushions, with toothless, bordered, oval leaves and nodding capsules. We show four common species and one uncommon one. Other uncommon species occur in our area but we rarely see them. We do see *Bryum caespiticium*, a close relative of *lisae*, but since it rarely fruits we don't know that we are seeing it.

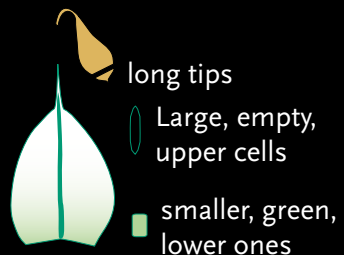
argenteum

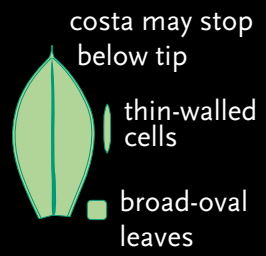
capillare

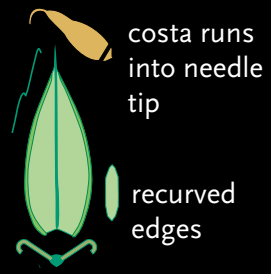
lisae

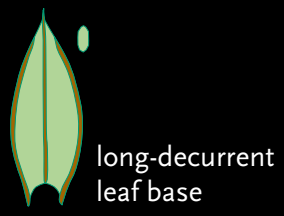
pallens

pseudotriquetrum

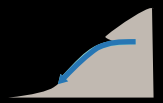








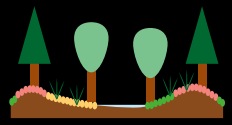
Open disturbed soil M Must know



Seepy ledge M Must know

Open disturbed soil M Must know

Calcareous seeps U Uncommon



Swamp M Must know

BRYUM ARGENTEUM Small, cylindrical, silvery shoots, oval leaves with needle tips, upper cells large and empty.

Small silvery plants with cylindrical, shoots, common in cracks in rocks, pavement, concrete, and masonry; between bricks or cobble stones; and among other mosses on disturbed soil. Leaves thin, with long needle tips, upper cells large and thin walled. The rare *Plagiobryum zieri* of cold limy cliffs is similar, but has larger leaves with longer basal cells and shorter tips.

Must know

leaves green below, silver-white above, tightly-overlapping, with needle tips

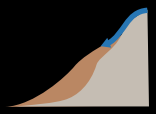
Shoots packed into dense cushions.

In a recess in a marble ledge, with *Nostoc* colonies.

BRYUM CAPILLARE Small bud-like plants in dense mats, leaves with a weak border, twisting and crumpling when dry; costa usually stops before tip.

Hedwigia ciliata

Small plants in dense cushions, commonest on wet rocks but also on soil and tree bases. Leaves broadly oval with needle tips and weak borders; costa often stops below tip; slender brood bodies often present, capsules uncommon.



Dirty wet ledges

Large cushions

Must know

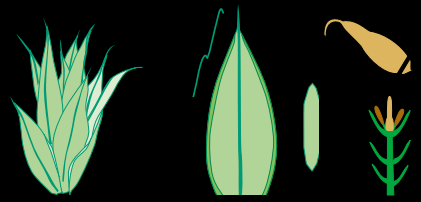
Plants short stemmed or budlike; Leaves broad oval with large cells, twisting up when dry; costa may reach the tip or stop below it, but doesn't emerge as a stiff needle point.

Plants tightly packed, short and bud-like, leaves wider than those of *Bryum lisae*.

BRYUM LISAE AND OTHERS

Small, light yellow-green, costa excurrent into a needle tip, abundantly fertile.

Small, very common, weedy moss of open disturbed soil. Plants short, bud-like, leaves oval with the costa excurrent into a long tip. Plants are monoicous—both sexes on stem—and abundantly fertile. The closely related and equally weedy *Bryum caespiticium* is dioicous, which, unless you like looking for sex organs on small weedy mosses, is hard to prove.



Budlike, bordered, long excurrent costa, monoicous, capsules with neck

Open soil

Thin doormat

Must know

Microscope needed

Long needle-tips to leaves, abundantly fertile. Separation from the similar *Bryum caespiticium* requires finding antheridia on the stems that have capsules.

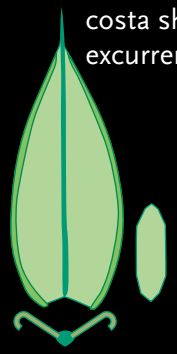
Bud-like plants, light-colored, bordered leaves with long points. Plants monoicous, sporophytes common.

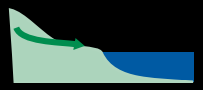
A mosscape on open disturbed soil, with reddish plants of *Bryum lisae* or *caespiticium* with spreading leaves mixed with green or silver budlike plants of *argenteum*. Other species may be there too. Once you know the needle-pointed leaves of the *lisae* group you will see them everywhere.

BRYUM PALLENS Tall, red in spring, thin-walled cells and long-rectangular basal cells; costa reaches the tip or emerges as an awn; capsules with clear necks.

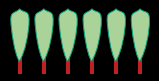
capsules with distinct necks

An uncommon species found near water; our pictures come from a calcareous river-shore seep. Plants tall, with red stems or all red in spring, the leaves short decurrent but without the large decurrencies of *pseudotriquetrum*. Costa reaches the tip or is excurrent, border is strong, cells are thin-walled, basal cells long rectangular.





Calcareous seeps



Groves

U

Uncommon

Microscope needed

BRYUM PALLENS (RED) *with DICRANELLA SCHREBERIANA* (GREEN)

Plants tall, red-pink in spring; leaves with short needle tips and strong borders, only sightly decurrent.

BRYUM PALLENS (RED) WITH *DICRANELLA SCHREBERIANA* (GREEN)

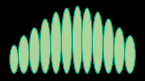
BRYUM PSEUDOTRIQUETRUM Tall, loosely clumped, with decurrent oval leaves and red stems.

elongate capsules, neck not demarcated

Common species of wetlands, shores, wet logs in lakes, seepy ledges. Often making large, loose tufts, sometimes scattered among other mosses. The combination of red stems, and slenderly oval leaves that are long decurrent at their bases is distinctive.

red stems, decurrent leaves with strong borders and recurved edges

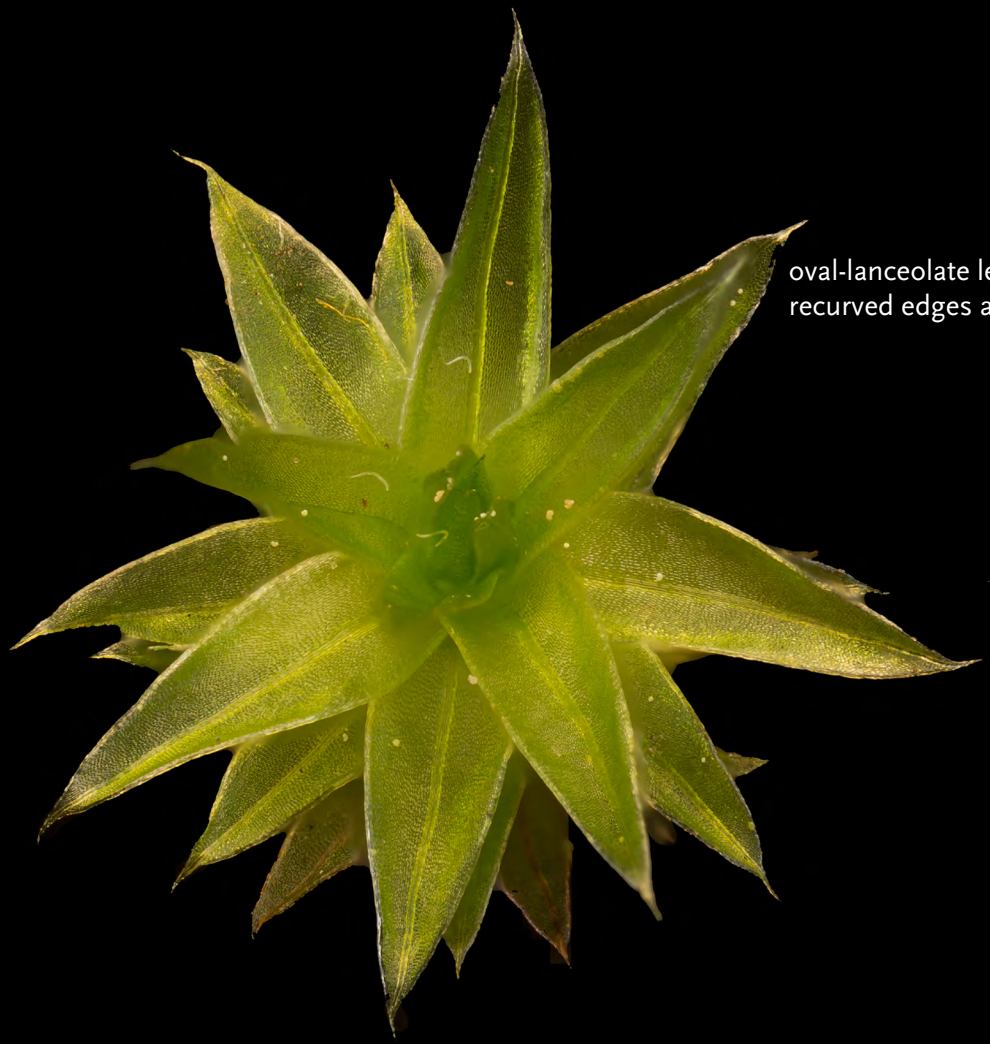
Open wetland



Loose mounds

M

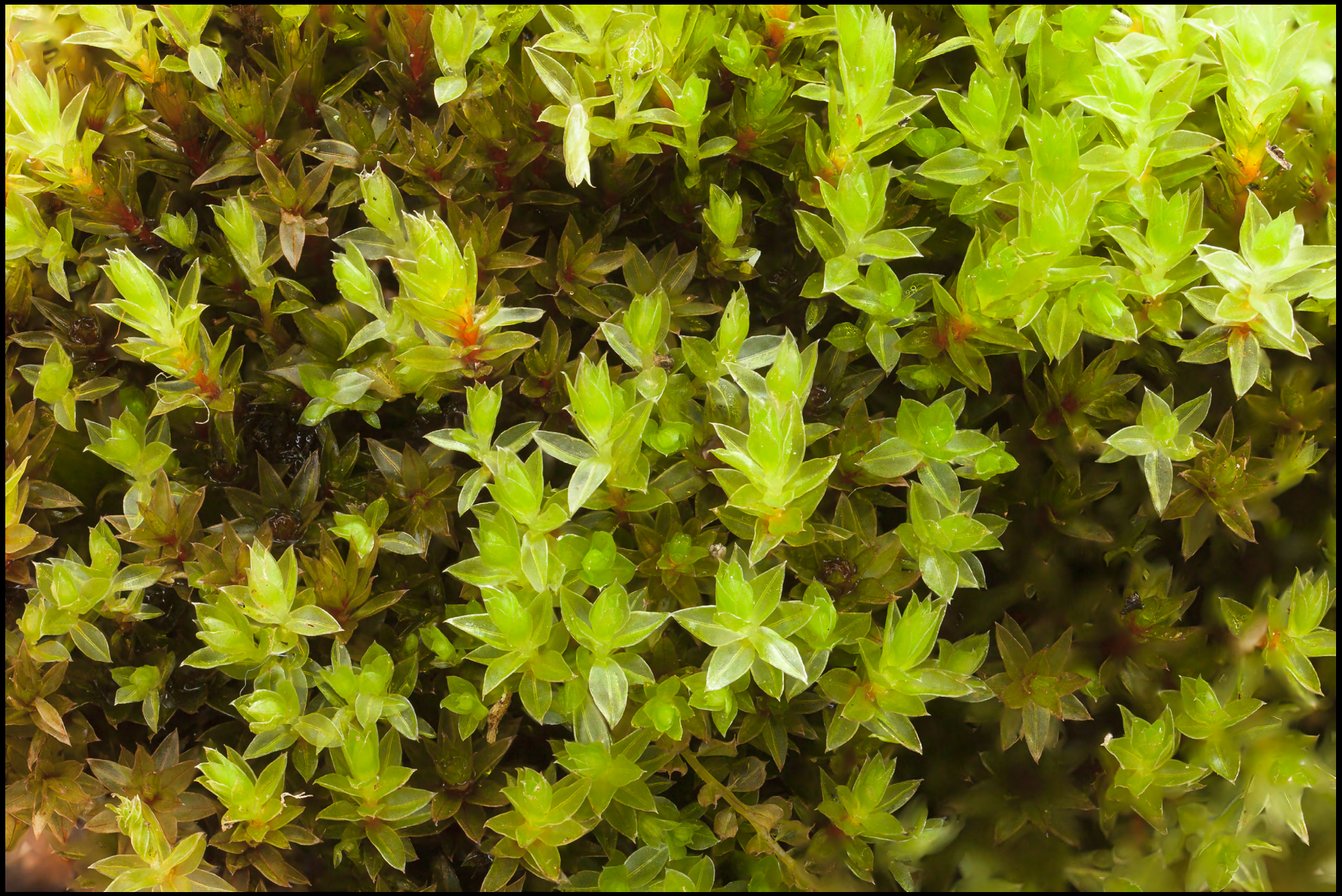
Must know



oval-lanceolate leaves with
recurved edges and short points

leaf bases run down stem

Oval, translucent, bordered, leaves with red stems. *Philonotis fontana,* common in similar habitats, also has a red stem, but the leaves are whiter and less translucent. *Pohlia wahlenbergii*, an uncommon species in the same habitats, has a red stem and silver-white leaves which aren't decurrent.



May make mounds or groves, or be scattered as single stems among other mosses.

BUXBAUMIA Tiny plants with large capsules; setae papillose; inner peristome a white pleated cone.

aphylla

F Identifiable in field

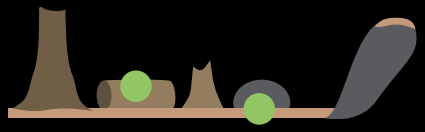
C Common in right habitat

minakatae

F Identifiable in field

R Rare

Small delightful oddballs, found on intermittently moist soil or rotting wood. The female plants are tiny and budlike, under 1 mm high, and grow from the edges of an inconspicuous protonemal mat; the males, which grow from the same mat, consist of a single leaf. The capsules are large, the setae rough, the peristome, like that of *Diphyscium*, a pleated cone. *Buxbaumia aphylla*, probably common but hard to find, grows on shaded soil; we look for it on moist banks. *Minakatae,* much rarer, grows on rotting wood, hidden among other mosses.



Forest interior

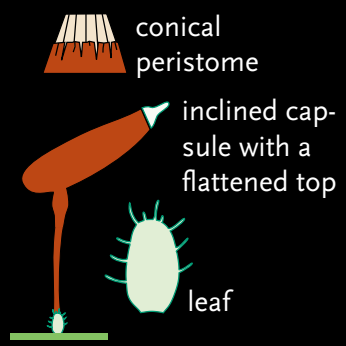
Protonemal mat

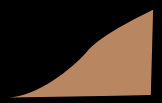
U

Uncommon

BUXBAUMIA APHYLLA Setae red, capsules flattened in cross-section, with a definite edge.

A widespread species, but inconspicuous, and takes some looking to find. It is not so much rare as local. You may find it in a 10 cm patch on a bank and not anywhere else on that bank. Or on that bank but not any others near by. So can be hard to look for.





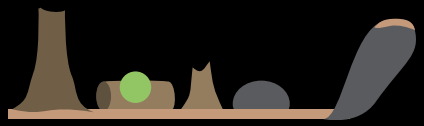
F
Identifiable in field

C
Common but local in the right habitat

With *Polytrichum juniperinum*, on calcareous soil in oak woods.

BUXBAUMIA MINAKATAE Capsules inclined, elongate, round in section.

An unusual plant with tiny leaves (not visible in the photo), and relatively large, inclined, rounded-cylindrical capsules. A rare, or at least rarely seen, species of well rotted wood. *Buxbaumia aphylla*, uncommon but not rare, has capsules that are flattened on top, like an anvil, and have a distinct edge. It is most often found on soil banks.



Forest interior

Scattered

R

Rare

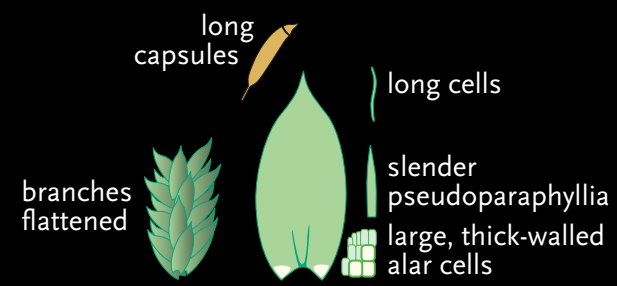
On moist rotting wood, with *Cladonia squamules, Dicranum, Callicladium, etc.*

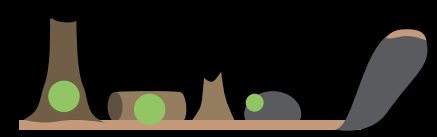
With *Dicranum* and new capsules of *Callicladium*.

Capsules slightly flattened, with rounded edges. *Buxbaumia aphylla* has strongly flattened capsules with definite edges.

CALLICLADIUM HALDANIANUM Loosely pinnate, with concave, untoothed, short-pointed leaves with short costas and enlarged alar cells on flattened branches.

An abundant moss making large patches on logs, tree bases, and occasionally rocks. A bit nondescript and correspondingly difficult to identify, despite its abundance. The best field marks are the slightly flattened branches, the concave leaves with short points, the long capsules, the shaggy look, and the yellow-green color. The leaves are closely overlapping at their bases but loose at their tips. *Entodon cladorrhizans* can look quite similar but has erect capsules and doesn't have the loose tips.





Forest interior

Loose thatch

Shingles

Must know

Microscope needed

A pinnate growth form on a log. The branches are flattened and somewhat sword-like, the leaf tips sharp but relatively short.

A shaggier and more irregular growth form, also from a log.

Small tree with a sheath of *Callicladium* and, below it, a sheath of *Plagiomnium*. On tree trunks, *Callicladium* makes loose shingles or fringes. The contrast between the yellow-green of *Callicladium* and the leaf-green of *Plagiomnium* is characteristic.

In a loose cushion on a log, mixed with *Hypnum imponens* and other stuff; long curved capsules, produced abundantly.

CALLIERGON Wetland mosses with blunt, concave leaves with strong costas, hooded tips, inflated alar cells, and rhizoid initials near tip.

cordifolium

D Locally dominant

M Must know

giganteum

D Locally dominant

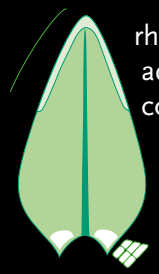
M Must know

stramineum

U Uncommon

Microscope needed

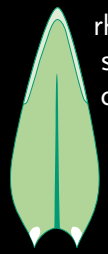
A common genus of medium-sized to large wetlands mosses, common in pools in swamps, and often, along with *Rhizomnium appalachianum,* dominant over large areas. Also in pools in bogs and fens. Recognized by the blunt, concave, hooded, untoothed leaves with strong costas and, microscopically, by the presence of rhizoidal initials (enlarged, clear cells in small groups) near the leaf tips. Our species fall into two groups: *cordifolium* and *giganteum* are large species, often much branched, that form big showy patches in wetlands; *stramineum* is smaller, sparsely branched, often inconspicuous, and grows in ditches, seeps, and wet crevices in rocks. The leaf cells differ, as shown below.



rhizoid initials adjacent to costa

costa ends near tip, alar cells nearly reach costa

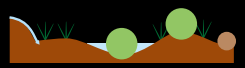
cordifolium, giganteum



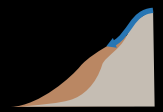
rhizoid initials separate from costa

costa ends below tip, alar cells reach less than half way to costa

stramineum



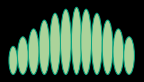
Open wetlands



Dirty wet ledges

Pipe cleaners

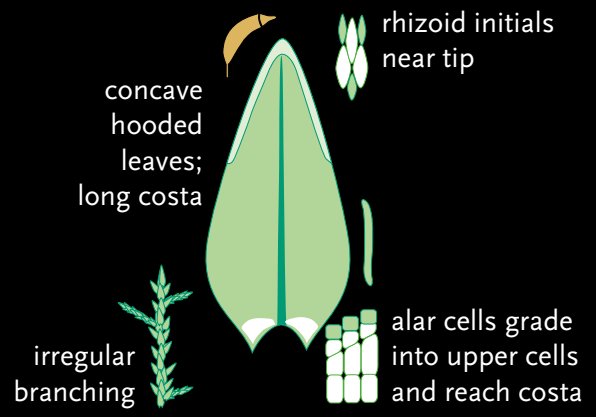
Rocks by water

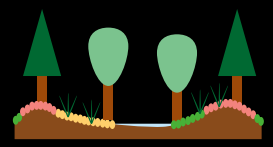


Loose mounds

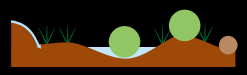
CALLIERGON CORDIFOLIUM Large moss, irregularly branched with blunt, rounded, concave, costate leaves; inflated alar cells almost reach costa and grade into the green cells above them.

One of the commonest big mosses of pools in shaded swamps, often associated with *Rhizomnium appalachianum*. Also found in pools in bogs and fens. Very similar to *Calliergon giganteum*: both have blunt, costate, leaves with the costa nearly reaching the tip and the inflated alar cells nearly reaching the costa. *Cordifolium* is less regularly branched than *giganteum*, and has less abruptly inflated alar cells.

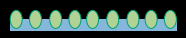




Swamps



Open wetlands



Loose wet mat

D

Locally dominant

M

Must know

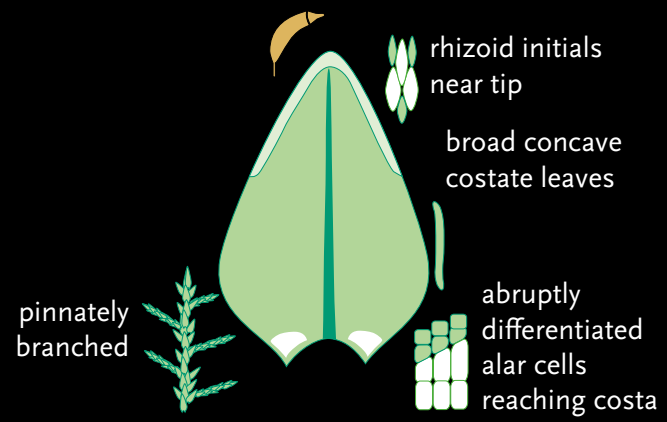
Microscope needed

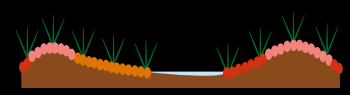
Young growth in a hemlock swamp.

Sparsely branched shoots, oval, concave leaves.

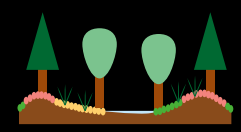
CALLIERGON GIGANTEUM Large pinnately branched moss with blunt, rounded, concave, costate leaves; inflated alar cells almost reach costa and are abruptly differentiated from the green cells above them.

The common *Calliergon* of limy swamps and fens, often associated with *Calliergonella, Limprichtia, Helodium blandowii, Hamatocaulis,* and other fen species. Similar to *Calliergon cordifolium* but with regularly pinnate branching and more abruptly alar cells. *Calliergonella cuspidata* is similar but lacks a costa.

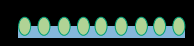




Calcareous fen



Fertile swamp



Loose wet mat

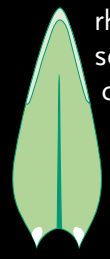
The pinnate branches take a while to appear in the spring; always wise to check the alar cells.

M Must know

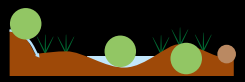
Microscope needed

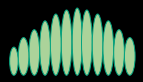
CALLIERGON STRAMINEUM Slender, sparsely branched, inflated alar cells extend less than half way to costa.

A relatively slender species, less conspicuous than *cordifolium* and *giganteum*, found casually in ditches, on shores, in seepage over rocks, sometimes in loose mounds or mats, sometimes mixed with other mosses. Recognized as a *Calliergon* by the blunt, concave leaves and strong costas and this species by the slender stems, rhizoid initials at the leaf tips that are separate from the costa, and alar cells that extend less than halfway to the costa.



costa ends below tip, alar cells reach less than half way to costa


Open wetland


Loose mounds

C

Common in right habitat

Slender shoots, leaves don’t spread much, irregularly branched, in loose mats.

CALLIERGONELLA CUSPIDATA Large, pinnate moss like *Calliergon* but without a costa. Young leaves rolled into points at branch tips.

A large, golden-brown, regularly branched species of wet pools in limy fens. The diagnostic features are the deeply concave leaves, with at most short and double costas, and conspicuous groups of inflated alar cells in three or more rows. The leaf tips point upward along the stems and are not curled to the sides; the young leaves are rolled into points at the branch tips; and the inflated alar cells have a few rows of square cells between them and the longer cells above.

Often grows with *Calliergon giganteum* and, in the north, *Scorpidium scorpioides*, and can look like either of them. *Calliergon* has a strong costa. *Scorpidium* has leaves that curve to one side at the leaf tips, only a few inflated alar cells, usually in a single row, and an abrupt transition from the alar cells to the leaf cells above.

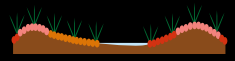
pinnately branched

leaves rolled into a point at branch tips

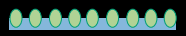
stem cortex inflated

oval, rounded, concave

large group of inflated alar cells



Calcareous fen



Loose wet mat

C

Common in right habitat

Microscope needed

CALLIERGONELLA CUSPIDATA

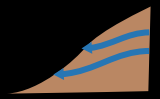
pinnate branching

Large, golden brown, concave leaves which are not curved or secund, no costa.

Pointed stem and branch tips, golden leaves, reddish stems; a wetland *Pleurozium* with inflated alar cells.

CALYPOGEIA SP. A small liverwort with shingled leaves in two rows; leaves slope up toward the tips of the stems and may have shallow lobes near the tip; underleaves are oval, with two lobes.

Typically in dense, olive-green mats, the plants much smaller than the similarly shingled *Bazzania trilobata,* growing closer to the ground, and having at most two tiny teeth at the leaf tips. Our commonest species, distinguished by the underleaves, are *fissa* and *muelleriana.*



Seepy bank

Low flat mat

CAMPYLIUM Leaves narrowed to channeled tips that arch out; costas and alar cells vary.

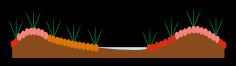
Loose wet mat

D

Locally dominant

M

Must know



Calcareous fen

Logs, tree bases

U

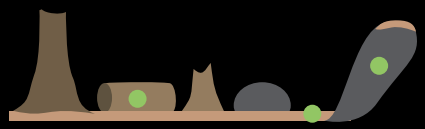
Uncommon

Low flat mat

Low flat mat

M

Must know



Logs, soil, rocks

A genus of convenience, containing mosses that may not be closely related. We have three species: *chrysophyllum* is a medium-sized species of rocks, soil, and wood, with a strong costa; *hispidulum* is a tiny species of rotting wood with a short double costa; and *stellatum* is a large species of marshes and fens, with a short double costa and inflated alar cells. All have similar leaf tips and are reasonably easy to recognize in the field. Otherwise they don't look much alike.

leaf tips arch out

dioicous

Costas and alar cells vary

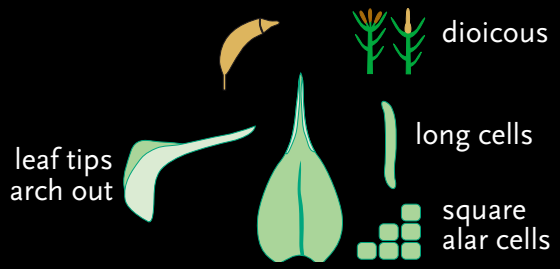
C

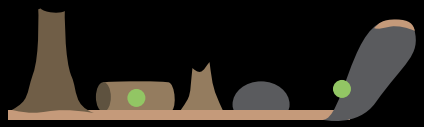
Common in right habitat

Microscope needed

CAMPYLIUM (CAMPYLIADELPHUS) CHRYSOPHYLLUM Leaves oval, narrowed to tips that arch out, with strong costas and small square alar cells.

A small, slender moss, frequent on moist limy rocks and occasional on rotted logs, growing in thin patches or mixed with other mosses. The generally strong (though variable) costas and arching tips are the most important characters. Found in all sorts of places; very common on moist limy soil.





Rocks, soil, wood

Low flat mat

Must know

Microscope needed

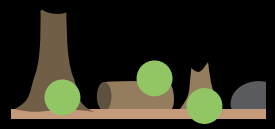
Leaves arching out from an erect, clasping base, with slender, inrolled tips and strong costas.

Loose or dense mats, irregular branching, glossy light yellow-green leaves with clasping bases and slender, needle-like tips that arch away from the stem.

CAMPYLIUM (CAMPYLOPHYLLUM) HISPIDULUM Tiny plants on rotting logs with spreading leaves with slender tips, short double costas, and small square alar cells.

A tiny species, often mixed with other mosses on tree bark or rotting wood, with spreading needle tips, short costas, and a few square alar cells. Leaves have small teeth; upper cells may project. Often identified by eliminating the other things that it isn't. *Lindbergia* is another small tree-bark species with widely spreading leaves; it doesn't have the channeled tips.

tiny, toothed leaves with arching tips and short double costas



Low flat mat

U

Uncommon

Microscope needed

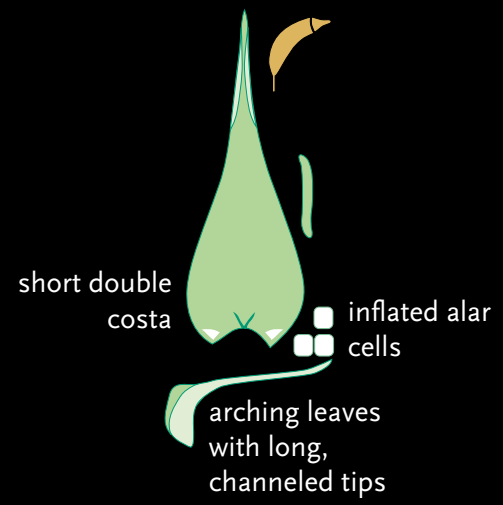
CAMPYLIUM (CAMPYLOPHYLLUM) HISPIDULUM

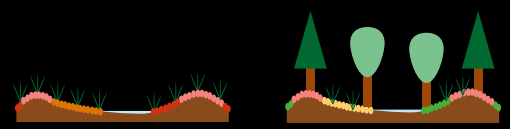
Tiny plants, the stems a few centimeters long, the leaves under a millimeter; leaves overlapping at their bases, arched outwards, narrowed to a slender tip.

In a loose mat on a log.

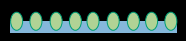
CAMPYLIUM (CAMPYLIADELPHUS) STELLATUM Medium-sized; leaves overlapping at their bases, with long, slender twisted tips; costa short and double, alar cells inflated.

Our largest and most abundant *Campylium*, a common dominant or co-dominant in wet hollows in fens and minerotrophic swamps. It is the only species in these habitats with lanceolate leaves without costas that arch outwards and have long slender twisted tips that point in all directions. Most of the other slender-tipped species in fens and swamps are either costate, or have curved tips, or both.





Calcareous fen Swamp



Loose wet mat

D Locally dominant

M Must know

Pinnate branching, leaves arch outwards, long needle tips that are twisted or wavy but not curved in one direction.

Yellow-green grading into brown; shoots look starry from above.

In a rich fen with bog bean, pitcher plant, and the sedge *Carex lasiocarpa*.

CAMPYLOSTELIUM SAXICOLA Tiny mosses with slender, linear leaves that are several layers thick and curly when dry; capsules slender, beaked, on curved setae.

A tiny moss of acid rocks with an Appalachian distribution, vary rare on acid boulders in the Northeast. Slender multistratose leaves, barely widened to the base, that curl up when dry; costa reaching the leaf tip but not excurrent. Capsules about 1 mm long, on curved setae about 5 mm.

We have only see it once, on a boulder in a mountain forest in western Massachusetts. The photos are crops from larger images and are grainy; it was in a recess in the boulder, and we couldn't get the camera as close as we wanted.

Tufts

F

Identifiable in field

R

Rare

Making a thin fringe near the lower edge of a shaded boulder. The capsules are about 1 mm long, the leaves 2-3 mm.

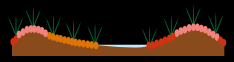
CATOSCOPIUM NIGRITUM Tiny moss with three-ranked leaves, dark lower stems, and black golf-club capsules.

tiny round capsules, appearing black in daylight.

A small moss of rich fens, often growing among other mosses. Sterile plants have lanceolate leaves and look like a *Pohlia,* but the lower stems are dark and the leaves are three ranked. The black golf-club capsules are unique. A far-northern species, extending into the high arctic and barely reaching our area in the Maritimes and northern Great Lakes.

spaced lanceolate leaves in three rows; dark lower stems

Small cushions



Calcareous fen

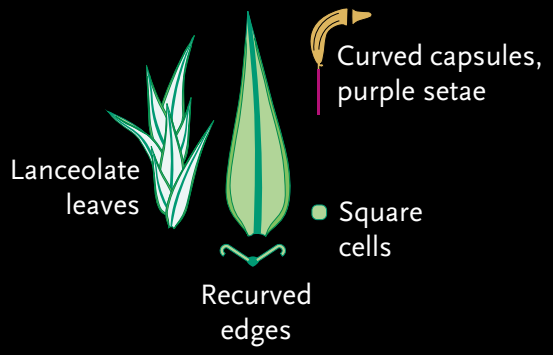
R

Rare

Leaves lanceolate, in three rows; lower stem dark.

CERATODON PURPUREUS Yellow-green, long-pointed leaves with recurved edges and a few teeth near the tip; square cells; red-purple setae, curved capsules with beaks.

A common species of open, sunny, disturbed mineral soil, fruiting abundantly and fairly easy to recognize from the dark, curved capsules, which often have a small basal swelling. Sterile plants have lanceolate leaves with recurved edges, square cells with medium-thick walls, and a few irregular teeth near the tip. These features are not unique, and, at one time or another, everyone is puzzled by sterile *Ceratodon*.

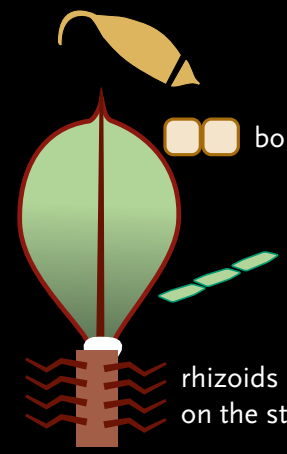


Lanceolate leaves with sharp points; on open mineral soil; dark red setae.

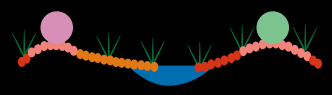
Leaves with recurved edges, looking thick-edged with a lens.

CINCLIDIUM STYGIUM A round-leaved moss with bordered leaves and black on the lower leaves and stems; leaves with short needle points; border one cell thick.

An arctic moss, rare in rich fens and seeps in the northern parts of our range. Plants large or small, round-leaved and bordered, often marked with black. Resembles *Rhizomnium* but has a one-cell thick border, small needle points on the leaves, and the rhizoids attached to the stem in lines.



old stems and leaves blackish



Rich fens

Groves Scattered

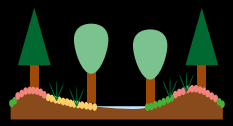
F Identifiable in field

R Rare

Microscope needed

CIRRIPHYLLUM PILIFERUM Oval costate leaves with long threadlike tips.

A small, light-colored, pinnately branched moss of moist forest floors. Uncommon in the northern forest. Our pictures are from fertile woods in the eastern Adirondacks. The oval, concave leaves with long soft tips are unique. *Bryhnia novae-angliae* looks similar and can grow in the same sort of places but has much shorter leaf tips.



Mixed swamp

Loose thatch

F

Identifiable in field

U

Uncommon

Stem leaves broadly oval, concave, with little curly tail-like tips.

Plants pale green, small, pinnately branched with wide branch angles, forming a loose thatch. *Bryhnia novae-angliae* has similar branching.

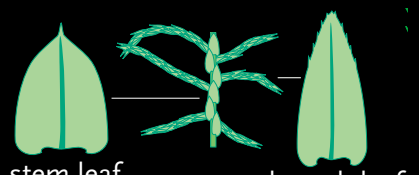
CLIMACIUM Tree-like growth, broadly triangular stem leaves, narrower branch leaves with conspicuous teeth.

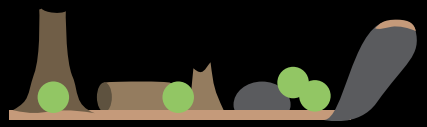
dendroides

americanum

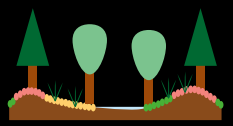
The two species are superficially similar. *Dendroides* is more northern, *americanum* more southern; both are found throughout the northern forest.

Two closely related species overlapping in morphology and ecology, not cleanly separable. Common on the floors of moist forests, on tree bases, logs, and dirty rocks, on hummocks in swamps, and on the banks of streams.



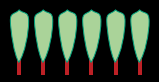


Trees, logs, rocks, soil



Swamp

Stream banks



Groves

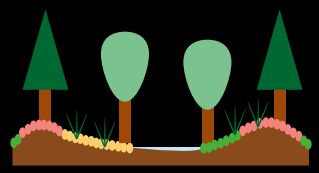
Treelike

Must know

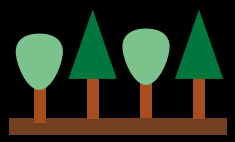
Microscope needed

CLIMACIUM AMERICANUM Tree-like growth, broadly triangular stem leaves, long cells.

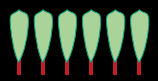
Common southwards in moist woods and swamps on logs, dirty rocks, tree bases, and soil. Approaching its northern range limits in the northern United States, and less common than *dendroides* in much of the northern forest. There are no good distinctions between the two; we follow Bruce Allen in using the shorter branch leaf cells and the more gradual taper of the tips of the stem leaves to separate *americanum*.



Swamps



Forest floors



Groves

Treelike

C

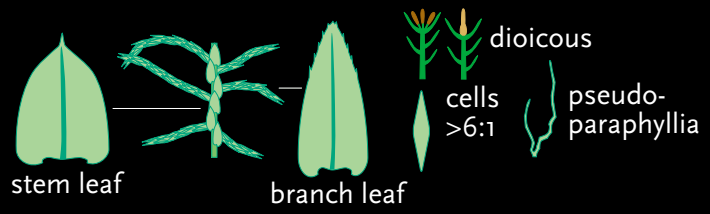
Common in
right habitat

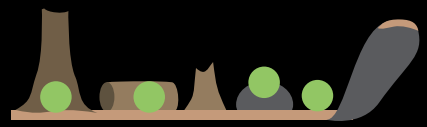
Microscope
needed

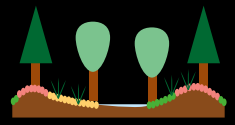
Plants treelike or sprawling, often forming a canopy.

CLIMACIUM DENDROIDES Tree-like growth, broadly triangular stem leaves that are abruptly narrowed to their tips; branch leaf cells > 6:1.

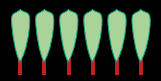
Common species of moist forest floors and tree bases, commoner under hardwoods than conifers, and often by the edges of pools and streams. Its size (2-8 cm high) and growth form distinguishes it from all northern forest mosses except the related *Climacium americanum*, which has longer cells, is more southerly, and is often found in swamps.




Trees, logs, rocks, soil


Swamp

Stream banks


Groves

Treelike

D
Locally dominant

Microscope needed

Old plants and a few new shoots, in seepage of the floor of a deciduous forest, in spring.

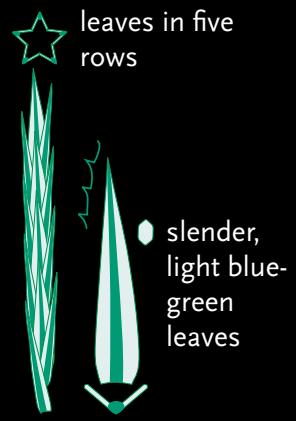
stem leaves pinched in at their tips

branch with
toothed and
pleated leaves

Colony on a stream bank in deciduous woods.

CONOSTOMUM TETRAGONUM Tiny blue-green moss; cylindrical shoots with slender leaves in five vertical rows.

A tiny, bright blue-green moss of moist, protected places in the alpine zone, growing in tufts or mats, often amidst other mosses, often under overhangs or in cracks. The bright color and the 5-rowed leaf arrangement, which makes the plants look like little stars when seen from above, are distinctive.



Alpine zone

Thin doormat

F

Identifiable in field

U

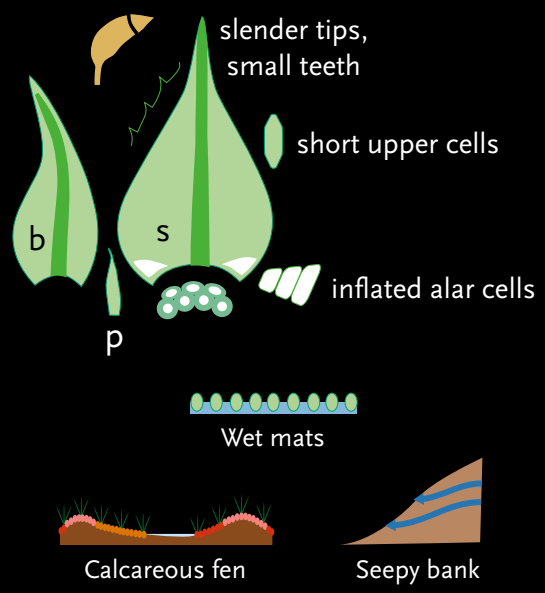
Uncommon

Leaves erect, needle pointed; shoots look star shaped from above; with *Gymnocolea inflata*.

With *Diapensia lapponica*, *Lycopodium selago*, *Carex bigelowii*, and *Sphagnum pylaesii*.

CRATONEURON FILICINUM A messy, brownish to blackish moss with pinnate branching and rhizoids along the stem, and broad stem leaves with slender tips. Leaves are toothed, with relatively short upper cells and large inflated alar cells; paraphyllia are present but scarce.

A characteristic moss of limy seepage and pools in rich fens, often low in the pools or semi-aquatic. Pinnately branched, often with hooked tips; broadly oval stem leaves with slender tips, small teeth above, and inflated alar cells. Varies from green to golden brown; often encrusted with lime and algae and almost black. Compare *Helodium blandowii*, with regular ladder-like branching, and *Drepanocladus* and its segregates with slender stem leaves and even more strongly curved branch leaf tips.



F Identifiable in field

C Common in right habitat

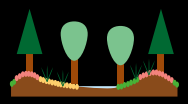
Microscope needed

Yellow-brown, curved branch tips, broad stem leaves with slender tips.

With *Pellia*. The leaves near the branch tips are often curved, resembling *Drepanocladus* or its relatives. The stem leaves of *Cratoneuron* are much broader than any of those.

CTENIDIUM MOLLUSCUM A frizzy-whacky moss with broad stem leaves, crazy leaf tips, and protruding leaf cells.

A light-colored, fluffy-looking moss of fertile swamps, commoner southwards, scattered and uncommon in the northern forest. Has pinnate branching and falcate-secund branch leaf tips and so looks something like a *Hypnum*. Differs from our Hypnums and most everything else in the broad stem leaves that are finely toothed and have short double costas and protruding cell tips.



Mixed swamp

Loose thatch

U

Uncommon

Microscope needed

The branch leaves are very curly, but not as neat or carefully arranged as a *Hypnum*.
The broad stems leaves are hidden among the branches and not visible here.

The branching is pinnate but not as planar as in the Hypnums and so the plants look bushier and messier.

CYNODONTIUM TENELLUM Slender-leaved moss with the leaf edges recurved below and thickened above, and the cells papillose; alar cells not differentiated; costa ending at the leaf tip and not long excurrent; capsules erect, without a swelling at the base.

A northern genus and species, uncommon with us, found in crevices in boulders in the alpine zone and near the northern Great Lakes. Leaves slender and long-tipped, curling when dry, resembling a small *Dicranum or Dicranella*. Which, unfortunately, many things do. The safest characters are microscopic: the undifferentiated alar cells rule out *Dicranum* and *Arctoa*, and the papillose cells and thickened upper edges rule out *Dicranella*. *Dicranella* and *Arctoa* mostly have curved capsules; *Dicranum* may have a straight capsule like *Cynodontium*.

Rocks by water

Alpine zone

Small cushions

Uncommon

Microscope
needed

Slender leaves, curly when dry, but costa not excurrent into a long needle tip; capsules erect, no swelling at base.

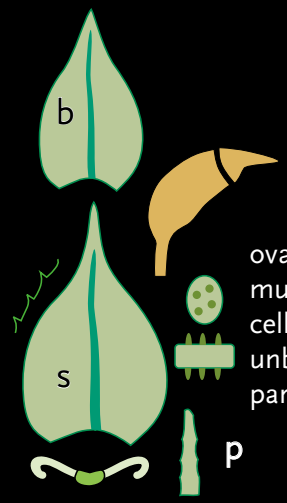
From moist shaded ledges near the summit of Mt. Mansfield, Vermont.

CYRTO-HYPNUM Small, wiry, once-pinnate or twice-pinnate mosses with multi-papillose cells with papillae on both sides; leaves costate; paraphyllia unbranched.

minutulum, on soil

pygmaeum, on marble

Small or tiny mosses of wood and limy rocks. Formerly a part of a broad *Thuidium* which was degenerated a few years back. Separated from *Haplocladium*, which is larger, by the multiple papillae; and from *Rauiella*, also larger, by having papillae on both surfaces of the cells. We have two species: *minutulum*, with smooth branches, on wood, and *pygmaeum*, with papillose.



oval leaves, multi-papillose cells, and unbranched paraphyllia (p)

Logs, soil, limy rocks and ledges

Low flat mat

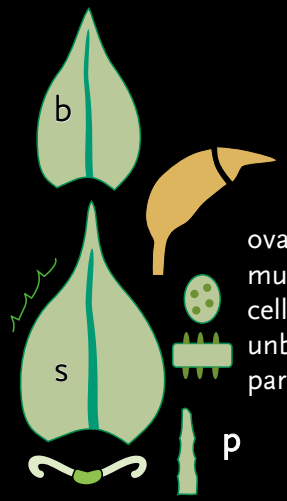
U

Uncommon

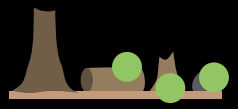
Microscope needed

CYRTO-HYPNUM MINUTULUM Small, wiry, once-pinnate or twice-pinnate mosses with multi-papillose cells with papillae on both sides; leaves costate; paraphyllia unbranched; stems smooth.

Small, mostly once-pinnate moss found on wood and soil. Separate it from *Haplocladium,* which is larger, by the multiple papillae; from *Rauiella,* also larger, by having papillae on both surfaces of the cells; and from *Cyrto-hypnum pygmaeum*, even smaller, by the smooth rather than papillose branches.



oval leaves, multi-papillose cells, and unbranched paraphyllia (p)



Logs, soil

Low flat mat

U

Uncommon

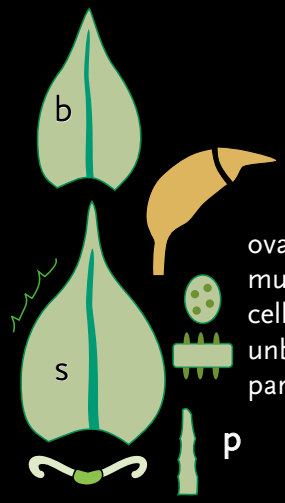
Microscope needed

Much like a tiny *Thuidium*, but only once or twice pinnate and with unbranched pseudoparaphyllia and cells with several papillae.

In loose, low mats on wood or soil. Note the fir needle in the center for scale.

CYRTO-HYPNUM PYGMAEUM Small, wiry, once-pinnate or twice-pinnate mosses with multi-papillose cells with papillae on both sides; leaves costate; paraphyllia unbranched; stems papillose.

A species of the south-central United States, near its northern limits here and rare with us. Very small and threadlike, once or twice pinnate, growing on limy rocks and soil. Separated from *minutulum* by the strongly papillose stems.



oval leaves, multi-papillose cells, and unbranched paraphyllia (p)

Limy rocks and ledges

Low flat mat

R

Rare

Microscope needed

Larger shoots often consistently twice pinnate; *minutulum* is largely once pinnate.

On a small piece of marble; plants tiny, looking like a *Platydictya* with pinnate branching.

CYRTOMNIUM HYMENOPHYLLOIDES Small, blue-green plants with broadly oval, untoothed, bordered leaves in flattened shoots.

A small, pretty moss found only in recesses in cold, limy cliffs, usually where there is some seepage. Often associated there with species like *Anomobryum julaceum* and *Myurella julacea*.

Calcareous seepage

Arching fronds

U

Uncommon

Small oval leaves with borders and needle points; borders one cell thick; plants blue-green.

In a recess on a moist cliff with calcareous seepage; with *Gymnostomum recurvirostre* and *Myurella sibirica*.
The new growth has very little contrast and the stacking software couldn't resolve it.

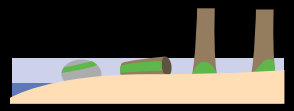
DICHELYMA Slender stringy mosses with long, narrow, sharply folded leaves that are arranged in three ranks. Cells long, alar cells undifferentiated.

capillaceum

falcatum

Semi-aquatic mosses, growing on wood in places that flood intermittently. The sharply folded leaves, arranged in three rows, are distinctive. We have three species and show two here. *Falcatum* is large and has sharp leaves over 1 mm long and capsules exserted beyond the perichaetial leaves. *Capillaceum* is smaller and has slender leaves with needle tips and capsules surrounded by the perichaetial leaves.

slender, sharply folded leaves in three rows



Intermittently submerged trees, shrubs, and wood

Loose thatch

C

Common in right habitat

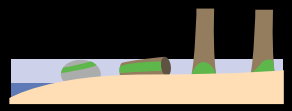
M

Must know

DICHELYMA CAPILLACEUM Slender curved leaves, mostly under 1 mm wide, with long needle tips, in three rows; capsules surrounded by perichaetial leaves.

A delicate species with long needle tips, locally common on logs, shrubs, roots, and bark that flood seasonally.

long slender leaves with costas excurrent into long needle tips



Intermittently submerged trees, shrubs, and wood

Loose thatch

C

Common in right habitat

M

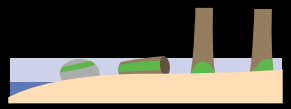
Must know

Slender curved leaves with long needle tips.

DICHELYMA FALCATUM Long, slender, sharply-folded leaves over 1 mm wide, in three rows; capsules exserted beyond perichaetial leaves.

Our largest *Dichelyma*, found on trees and logs in the flood zone of rivers and, according to Bruce Allen, on rocks by brooks. The exserted capsules and wide leaves are good marks.

slender sharply folded leaves over 1 mm wide, in three rows



Intermittently submerged trees, shrubs, and wood

Loose thatch

D Locally dominant

M Must know

Long, sharply folded leaves, the largest over 1 mm wide, in 3 rows.

Capsules at the tips of leafy branches, not surrounded by leaves.

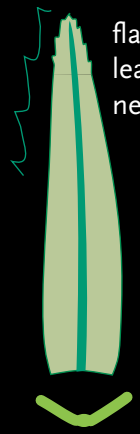
Growing on the base of a silver maple in the flood plain of Otter Creek, Cornwall, Vermont.

The flood plain of Otter Creek, Cornwall, Vermont. The spring high-water line is about a meter above the ground. *Dichelyma falcatum* grows near the tree bases; above that the trees are bare, probably scoured by ice; above the high-water line are common tree-bark mosses that don't tolerate scouring.

DICHODONTIUM PELLUCIDUM A small lanceolate-leaved moss that grows in patches on rocks by streams; leaf tips with a few coarse teeth; cells with a single tall papilla.

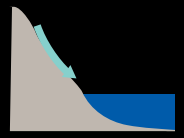
With *Myurella julacea*.

A small slender-leaved moss that forms patches on rocks by streams, often where there is calcareous seepage. Looks like *Gymnostomum* or *Didymodon* but isn't. We have trouble recognizing it in the field and rely on microscopic characters: the cells have a single high papilla and the leaves have a few teeth near the tips.

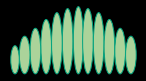


flat lanceolate leaves with teeth near the tip

cells with tall single papillae



Rocks with seepage by water



Loose mounds

U

Uncommon

Leaves slender, tapering to an acute tip; plants in mounds or mats.

Edges not thickened or recurved.

DICRANELLA Slender-leaved mosses, often narrowed from a sheathing base to a long tip, with smooth leaf cells and undifferentiated alar cells; capsules inclined; peristome teeth split.

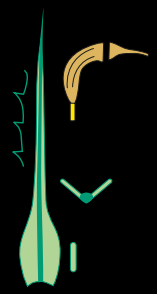
heteromalla

Small slender-leaved mosses with undifferentiated alar cells and short inclined or curved capsules with forked peristome teeth, looking indeed like small Dicranums in the field and hence, by extension, like Cynodontiums, Trematodons, Arctoas, Ditrichums, and others. We show three species here. At least four others, which we have not photographed, are rarer.

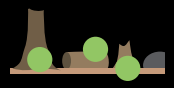
Heteromalla, with long wispy leaf tips and capsules that are contracted under the mouth and furrowed when dry, is the commonest. It is identifiable in the field from the capsules with yellow setae and perhaps, with fingers crossed, under the microscope from the leaves.

Schreberiana, with leaves that clasp at their bases and arch outwards to a long-pointed tip, is vegetatively distinctive and easily identified in the field.

Varia is small and nondescript vegetatively—basically a small *heteromalla* that may have recurved edges—but has red setae and peristome teeth that are fairly distinctive.



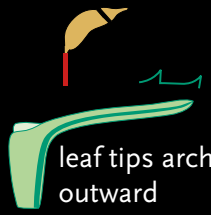
heteromalla



Tree bases, logs, soil, rocks

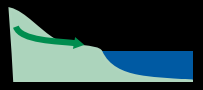
C — Common in right habitat

M — Must know

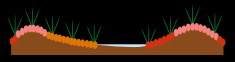


leaf tips arch outward

schreberiana



Limy seep



Calcareous fen

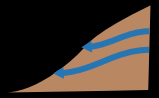
F — Identifiable in field

R — Rare

red seta and peristome; open limy soil

varia

Limy ledges and soil



Seepy bank

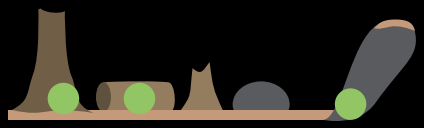
F — Identifiable in field

U — Uncommon

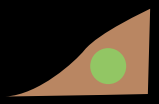
DICRANELLA HETEROMALLA Small plants with slender leaves with long tips, capsules constricted under the mouth and furrowed when dry.

Our only common *Dicranella*, making extensive mats and cushions on shaded soil banks, in burnt or disturbed ground, also found in dry crevices in ledges, under boulders, on tree bases and logs. Recognized presumptively by its abundance and by the slender leaves with the costa excurrent into long, sharply toothed tips. The yellow setae and arching capsules that are constricted under the mouth when dry confirm it. Sterile plants are very close to *D. cerviculata* and *D. subulata*.

Leaves with long excurrent tips, alar cells not enlarged, capsules curved, contracted under the mouth when dry.



Forest interior



Soil bank

Small cushions

Thin doormat

Must know

Microscope needed

Slender leaves with long tips filled with the costa. Dicranums have inflated alar cells and broader tips.

Often in mounds.

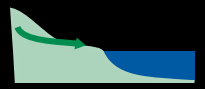
Vegetative plants are recognized as a *Dicranella* by the long leaf tips, but are difficult to separate from *Dicranella cerviculata* and *subulata*; sterile plants of *Ditrichum*, *Leptobryum*, and *Trematodon* are also similar.

DICRANELLA SCHREBERIANA A distinctive wetland species: leaves widely separated, with clasping bases and long tips that arch outwards.

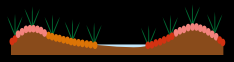
An uncommon species of limy wetlands with distinctive long-tipped leaves that arch outward from limy bases. We have seen it in rich fens and seeps; it is also reported from ditches and ledges. *Dicranella palustris*, another northern species, is similar but has rounded tips.

leaf bases clasp; leaf tips arch outward and are sharply pointed

Small cushions



Limy shore



Calcareous fen

F

Identifiable in field

R

Rare

DICRANELLA SCHREBERIANA (green) and *BRYUM PALLENS* (pink)

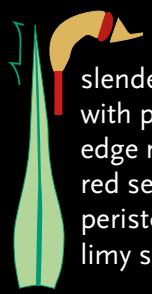
Leaves widely spaced, their bases clasping the stem, their tips divergent and sharp.

DICRANELLA SCHREBERIANA (green) and *BRYUM PALLENS* (pink)

The divergent leaf tips look starry from above.

DICRANELLA VARIA A small moss, resembling *Dicranella heteromalla* but with broader leaves with recurved edges and red setae and peristome.

A small moss of moist limy soil, not well marked vegetatively but recognizable from the red setae and peristomes when in fruit. Locally common on open moist limy soil, often where there is disturbance; we see it on river banks, thin soil over ledges, and borrow pits.



slender leaves with parts of the edge recurved; red seta and peristome; open limy soil

Groves

Open limy soil

F

Identifiable in field

U

Uncommon

Leaf tips slender, but not as long as in *heteromalla*; setae and peristomes red.

DICRANODONTIUM DENUDATUM A slender-leaved moss with long wispy tips; leaves inrolled above, with toothed tips; costa broad, not sharply differentiated from the blade; alar cells inflated; older leaves fall off, leaving bare stems.

leaves fall from older branches

A forest moss of the central Appalachians, usually found on rocks and uncommon with us, resembling a *Dicranum* with particularly long silky tips. The costa is broad, the alar cells are inflated, and the old leaves fall off and leave bare places. It can probably be identified in the field by someone familiar with it, but it looks enough like *Dicranum fulvum, Dicranella heteromalla,* or *Paraleucobryum longifolium* that a microscope check is essential.

Dry boulders, ledges

Tufts

Uncommon

Microscope needed

Wispy tips, broad indistinct costas. The lower stems are supposed to be bare, but aren't.

DICRANUM Large or small, with slender leaves, and reddish inflated alar cells.

The second largest northern forest genus, and one of the commonest. Uniformly narrow leaved, with inflated and often red alar cells. Otherwise small or large, straight-leaved or curved, spreading or curled when dry. Compare *Arctoa* (small with wispy tips), *Dicranodontium* (long slender tips, broad costas) and *Blindia* (red stems, erect inrolled leaves), all of which also have slender leaves and inflated alar cells.

With practice, most of our species can be recognized in the field, at least provisionally, and at least when fertile. The main exception, curiously, is *scoparium*, which is both one of our commonest species and our most variable. Because of the variability any plant that looks *scoparium* (including plants of *fulvum, ontariense, fuscesens, elongatum, majus,* and *bonjeanii*) needs to go to the microscope.

Our species divide into three groups, based on capsules and upper cells. Group 1, sometimes separated as *Orthodicranum,* has erect capsules and short upper cells. It is easily recognized in the field when fertile. Many of the species of Group 2 (short upper cells, inclined capsules) and Group 3 (longer, porose upper cells, inclined capsules) can be recognized individually; the groups as a whole can't be told apart in the field.

Group 1: erect capsules, short upper cells

flagellare

fulvum

montanum

viride

Group 2: inclined capsules, short upper cells

elongatum

fuscescens

ontariense

spurium

undulatum

Group 3: inclined capsules, long porose upper cells

scoparium

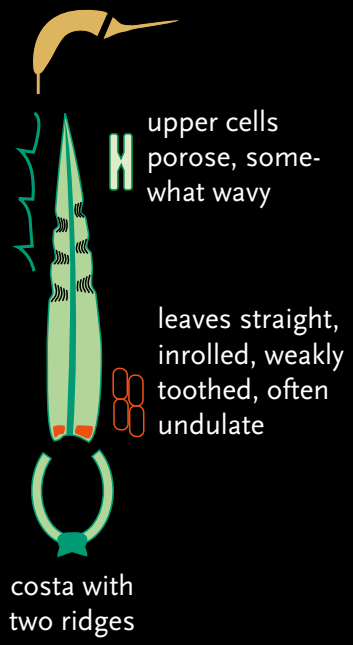
majus

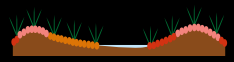
bonjeanii

polysetum

DICRANUM BONJEANII Large plants with straight leaves, porose upper cells, weak teeth or none, and two weak ridges on the costa.

A bog and fen species, close to *scoparium* and like it with elongate, porose upper cells and a ridged costa. Differing, not always decisively, in the straighter leaves which are smooth or weakly toothed, and have at most two ridges on the costa. The leaves may be wavy, resembling *Dicranum undulatum*, which has shorter, nonporose upper cells and often has the upper leaves twisted together.





Calcareous fen

Large cushions

R

Rare

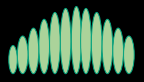
Microscope needed

Plants large, leaves undulate, not falcate secund like *scoparium*. Can look like *undulatum* in the field.

May form dense mounds.

DICRANUM ELONGATUM Slender and tall; leaves inrolled, without teeth or costal ridges; upper cells short, nonporose.

A far-northern species, rare in alpine areas in the northern forest. Large plants in clumps, resembling a slender form of *Dicranum scoparium*, but with smooth inrolled leaves, short smooth upper cells, and no ridges on the costa. Once you have it under the microscope, nothing else looks like it.



R

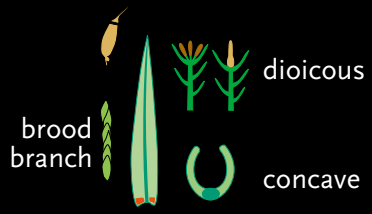
Rare

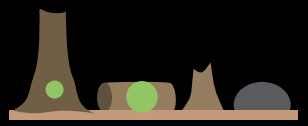
Microscope needed

Tall plants with slender stems, long curved leaves; resembles *scoparium* in the field.

DICRANUM FLAGELLARE Dense mats, concave, untoothed leaves, small reproductive branches with tiny leaves.

Common and often abundant, forming dense mats or cushions on logs, tree bases, roots, and mounds, always near the forest floor. Easily identified when the brood branches are present, but requiring the microscope (toothless, smooth, 1-layered, tubular leaves) when they are not. Often with *D. montanum* and *D. viride* on logs, and *Leucobryum* on mounds.





Forest interior

Thin doormat

Must know

Microscope needed

With *Polytrichum pallidisetum*. The loose stringy things are brood branches.

Enlargement showing brood branches. The largest are 2-3 mm long; their leaves are rudimentary and barely visible.

brood branches
Polytrichum pallidisetum

Smooth, inrolled, somewhat tubular leaves, in dense mats or mounds. When brood branches are absent, it can be confused with other untoothed species with inrolled leaves. The short upper cells and alar cells in a single layer are critical characters.

Brood branches are hidden among the leaves when young. They can almost always be found.

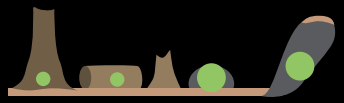
DICRANUM FULVUM Leaves inrolled and tubular near the tips, two-layers thick in upper parts; plants often dark black green in field; costa without ridges; capsules erect.

Large conspicuous mats on ledges and boulders, also in small quantities on tree bases and logs. Variable in size, resembling (and often growing with) *Dicranum scoparium* when large and *Dicranum flagellare* when smaller. The safest distinctions are microscopic: *fulvum* has papillose leaves, a broad costa, filling 1/3 of the leaf base, and is our only species with the upper leaf blades two layers thick. Fertile plants can be identified by the combination of medium size, long slender leaf tips and erect capsules. Sterile plants go to the microscope.

capsules erect

leaves two-cells thick in upper parts

leaves inrolled, straight or curved



Forest interior

Thin doormat

D

Locally dominant

M

Must know

Microscope needed

Makes large, often patchy, thin or thick mats on boulders and ledges.

Leaf tips lender and tubular, often falcate secund, curly when dry.

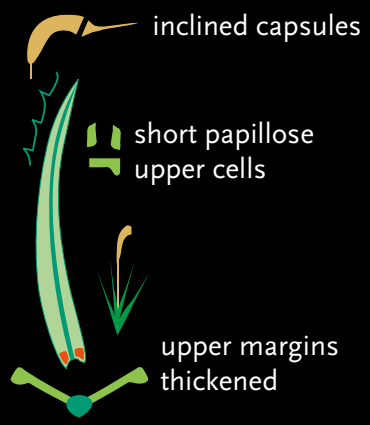
The erect capsules, and likely much of the foliage, is *fulvum*; the strongly inclined capsule in the circle is *scoparium*.

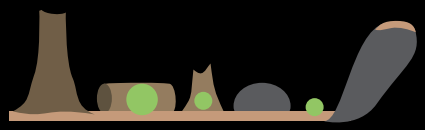
Curly when dry and looks a lot like other species. You have to check for the multilayered leaves.

Often in small scruffy patches.

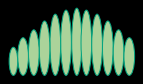
DICRANUM FUSCESCENS Large plants with dense white or red fur (rhizoids) on the stems, leaves crisped when dry; leaf margins thickened; cells papillose; upper cells short, nonporose; capsules inclined.

A common, though hard to recognize, northern species of stumps, logs, and the forest floor. Resembles *Dicranum scoparium* but has the leaves crisped when dry, and also *Dicranum ontariense*, which has the multiple setae and the leaves even more curled. The safest characters are microscopic: short upper cells that are papillose below and thickened upper edges.





Forest interior



Loose mounds

Tufts

C

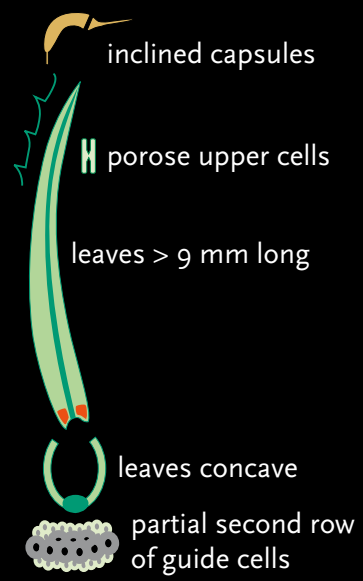
Common in right habitat

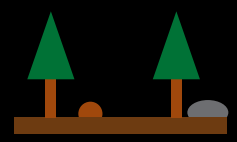
Microscope needed

Often in loose mats or small tufts on rotting wood; here with *Leucobryum, Tetraphis,* and little no-account liverworts.

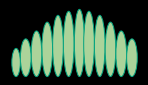
DICRANUM MAJUS Large and handsome, with long curved leaves and inclined capsules, and multiple setae; upper cells elongate and porose; costa in cross-section with a main row of large "guide cells" plus additional guide cells outside that row.

A striking northern species coming into our range in boreal forests along the northern Atlantic coast. Tall plants with curved leaves, resembling *scoparium* in the elongate, porose upper cells and curved capsules. Distinguished from it by having multiple setae per stem (though not consistently), longest leaves over 9 mm long, and inrolled, concave leaves without ridges on the costa. A good, but not always clean, lab character is that row of guide cells in the costa is two cells thick in places. Like many of the Dicranums with inclined capsules, *majus* is "pseudautoicous" with dwarf male plants developing from spores that germinate on the rhizoids of the female plants.





Rocks and soil in boreal forest



Loose mounds

F

Identifiable in field

U

Uncommon

Microscope needed

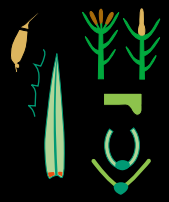
Long curved concave leaves.

With the liverwort *Bazzania trilobata*. The multiple setae are clear here but can twist together and be hard to see in the field.

In the ravine of Hastie Brook, Fundy National Park, New Brunswick, a few hundred meters from the Bay of Fundy. *Majus* is tall and skinny and grows in open clumps. The lens, like our eyes, can't resolve it well at a distance. I look for a big moss that is hard to focus on.

DICRANUM MONTANUM Small, with tubular, papillose leaves that are strongly curled when dry.

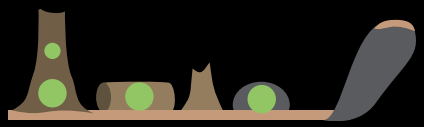
Small and very common, in small, rounded, dark cushions on tree bark or rocks or more extensive mats on logs. Often grows with *Dicranum flagellare* and *Hypnum pallescens*, and (with *Ptilidium pulcherrimum* and *Hypnum pallescens*) one of the few mosses that grows on the bases of pines. Usually recognizable by the small size (leaves < 5 mm), dense clumps, and curly leaves. Critical microscopic characters are the short upper cells that are papillose below and the uniformly one-layered leaf blades.



dioicous

papillose below

concave or keeled



Forest interior

Thin doormat

Small cushions

Must know

Microscope needed

Extensive patches on a well rotted log, with *Tetraphis pellucida*.

Strongly curled when dry.

Plants very small, very curly when dry, in dense cushions.

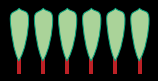
Small erect capsules, leaves slightly curly when wet. With *Tetraphis*.

DICRANUM ONTARIENSE Medium-sized woodland species resembling *scoparium* and often growing with it; upper cells short, margins not thickened; leaves curly when dry, sometimes ripply when moist; may have several setae per stem.

Common species of conifer woods along the northern coast, uncommon inland, making tufts or small groves on the forest floor. Resembles *Dicranum scoparium* and *fuscescens* and often grows with them. Distinguished in the field by the multiple setae and the leaves that are strongly curled when dry, and microscopically by the short upper cells and the lack of any thickening of the upper margins.

Forest interior

Tufts



Groves

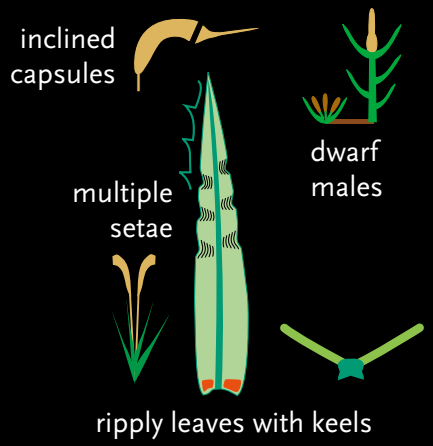
C

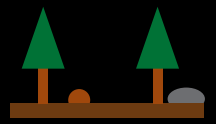
Common in right habitat

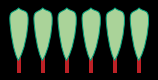
Microscope needed

DICRANUM POLYSETUM Large and shiny, forming groves, with ripply leaves that spread in all directions and do not curl. Upper cells elongate and porose; leaves keeled; stems may have several setae.

Abundant and often locally dominant species of boreal forest floors, covering large areas, often associated with *Polytrichum commune*, *Ptilium crista-castrensis,* and *Hypnum imponens*, the other important coveralls. Large plants with relatively straight leaves that have crosswise pleats (ripples) dry or wet and do not curl when dry. *Dicranum scoparium* and *Dicranum ontariense* are similar and often found with it. *Scoparium* lacks ripples and often has curved leaves. *Ontariense* has (weaker) ripples and is strongly curled when dry. Two wetland species, *bonjeanii* and *undulatum,* have ripply leaves that are less spreading and leaves that are concave rather than keeled.




Boreal forest floor


Groves

D
Locally dominant

M
Must know

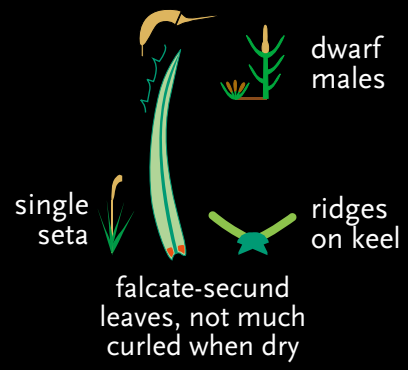
A grove of *polysetum*, with a few plants of *Pleurozium* (red stems). The loose growth allows the fir needles to sift through.

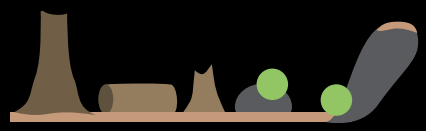
Long ripply leaves radiating in all directions. The largest leaves here are about 8 mm long.

On the boreal forest floor, with *Cladonia rangiferina*.

DICRANUM SCOPARIUM Large plants with curved (falcate-secund) leaves, usually toothed on the edges and with toothed ridges on the costa; upper cells elongate and porose.

Common and conspicuous, making cushions on rocks and on the forest floor, or smaller tufts mixed with other species. Large plants are usually recognizable in the field by the long leaves curved in one direction and sharp teeth; and smaller plants, microscopically, by the long cells and ridged costa. Care must be taken to differentiate *Dicranum ontariense* (shorter cells, curled leaves) and *Dicranum fuscescens* (shorter cells, margins thickened). None of these characters is completely reliable: *scoparium* is famously variable, and puzzling specimens are surprisingly common.





Forest interior

Large cushions

Tufts

Common in right habitat

Microscope needed

Form with falcate-secund leaves.

Form mixing falcate-secund and relatively straight leaves.

Making dense mounds, with the grass *Deschampsia flexuosa*, on a seepy woodland bank.

A small shade form, with *Cladonia cf. coniocraea* and *mitis*, on a mound in deciduous woods.

Small compact plants on a quartzite rock, strongly resembling *Dicranum fulvum*. You will either need capsules or a microscope for these.

DICRANUM SPURIUM Leaves broad at base, concave above rather than keeled, slightly undulate.

A large *Dicranum* of dry habitats, most often seen among lichens or other mosses in sandy or rocky barrens. The oval bases of the leaves and interrupted or tufted appearance of the shoots are good field characters. Confirmatory characters are the concave leaves that are undulate but not strongly crisped when dry, and the small, thick-walled, angular upper cells that are papillose below.

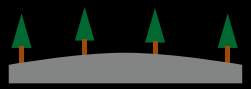
interrupted growth

small, angular, upper cells, papillose below

concave leaves with oval bases

inclined capsules

dwarf males attach to females



Rocky or sandy barrens

Groves

Scattered

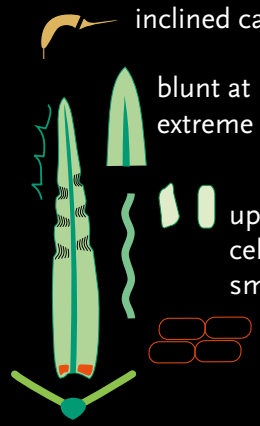
C

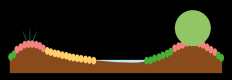
Common in right habitat

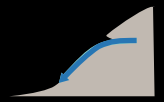
Microscope needed

DICRANUM UNDULATUM Leaves erect and wavy (but not curled) when dry, upper leaf cells short, commonly on hummocks in bogs.

A large *Dicranum* with undulate leaves that are straight and erect at the stem tips when dry, and stems with a segmental growth pattern in which a dense tuft of closely spaced leaves is followed by a section with a few widely spaced ones, and then another tuft. Often the uppermost leaves are erect and twisted together. Most often seen at the tops of hummocks in open bogs, with the slender form of *Polytrichum juniperinum* called *Polytrichum strictum*. *Dicranum bonjeanii*, a fen species, can look quite similar but has elongate and porose upper cells.




Open bog


Seepy ledge

Small cushions

Uncommon

Microscope
needed

Young leaves erect, wavy, the upper ones twisted together. Older growth segmental.

A clump from a seepy crack in coastal ledges, Milbridge, Maine.

DICRANUM VIRIDE Stiff, concave, widely-spreading leaves with broken tips; upper cells short, leaves and cells smooth.

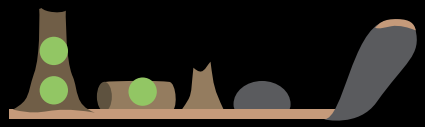
A frequent or common species of tree bark or fairly moist logs, but found in small quantities and not particularly conspicuous. Small to medium-sized, rather dark, with a loosely tufted growth form, stiff leaves that curl very little when dry, and broken-off leaf tips. Often associated with *montanum* and *flagellare*. Any *Dicranum* can have a few broken tips; it is the regular breaking of many tips that distinguishes this species.

broken tips

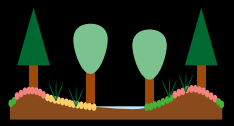
inrolled, no teeth

erect capsules

dioicous



Trees, logs



Wet wood in swamps

Small cushions

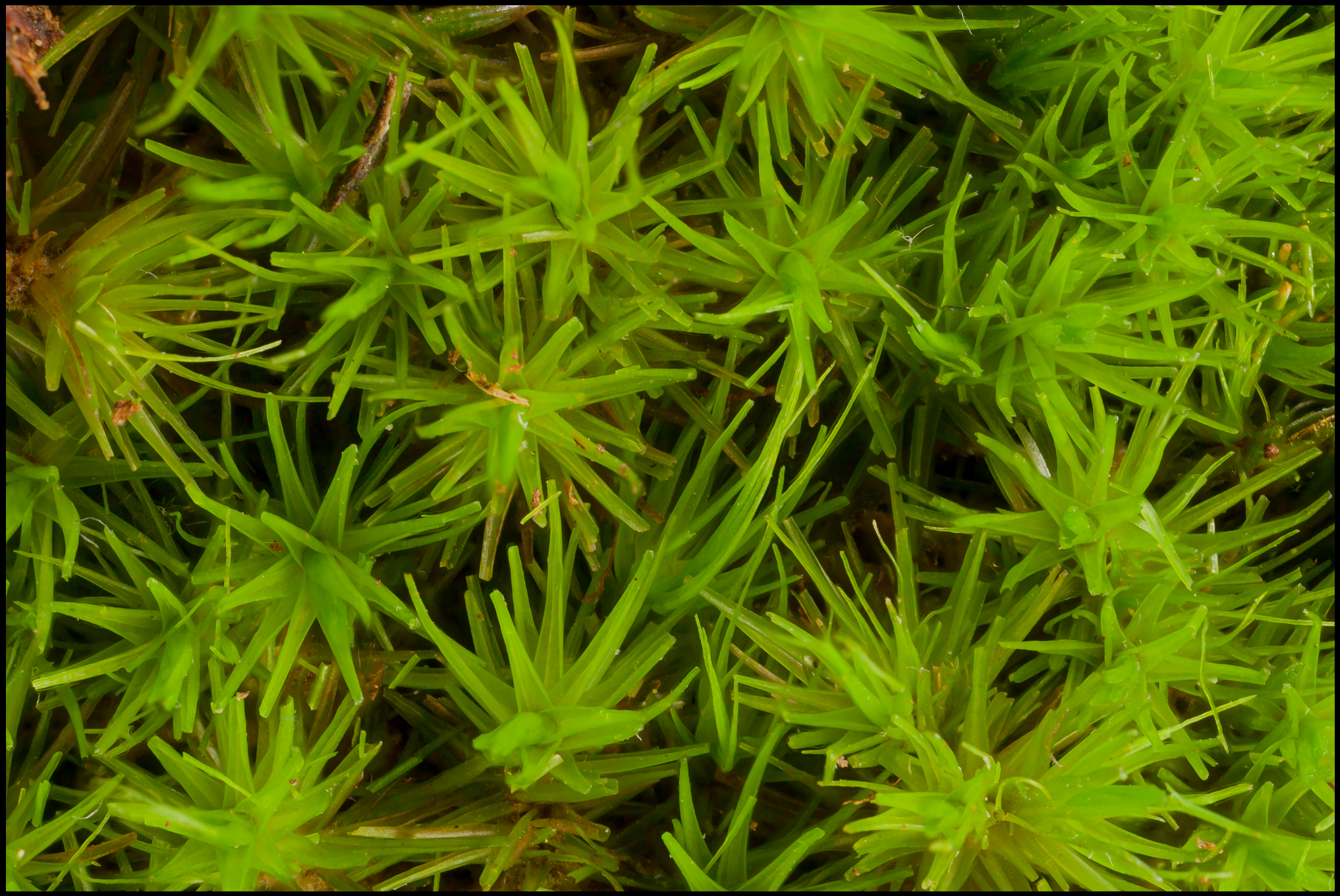
Tufts

M

Must know

On a rotten log at the edge of a small woodland pool.

Tufted growth, regularly broken tips.



The tips break in a weak zone, at about the same distance above the base. The broken tips likely function as propagules.

DIDYMODON Small, yellow-green moss with lanceolate leaves that taper from broad bases and are often spreading or recurved; cells with indistinct papillae.

rigidulus

Small, difficult, weakly papillose mosses, found in moist limy places. Resembling *Gymnostomum* and *Hymenostylium,* but with less distinct papillae and more tapered leaves. The species are close and must be separated with a microscope. *Fallax* and *ferrugineus,* which both have the long cells of the costa exposed above, differ mostly in the extent to which the leaves are folded and recurved. *Rigidulus* has the upper side of the costa covered by short cells and the costa excurrent into a blunt point.

ferrugineus

fallax

Calcareous rocks or soil

Calcareous seepage

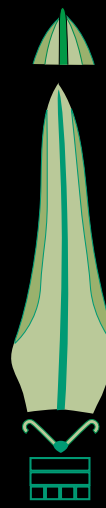
C

Common in right habitat

Microscope needed

DIDYMODON FALLAX Small, yellow-green moss with lanceolate recurved leaves that taper from broad bases, low papillae, and long cells of the costa exposed above; leaves spread but do not arch downwards when wet.

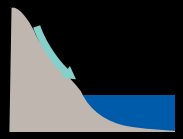
Small moss without striking field characters, with low papillae, weakly folded leaves, long cells of the costa exposed above. The wet leaves spread but do not hook downwards, and will, or at least are supposed to, lie flat on a slide. *Didymodon ferrugineus,* which is closely related, differs in having reflexed leaves that lie on their sides. This is not a big difference.



leaves weakly folded, spreading rather than reflexed

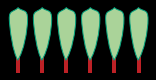
obscure papillae

elongate cells of costa exposed on upper surface



Rocks with seepage by water

Calcareous rocks or soil

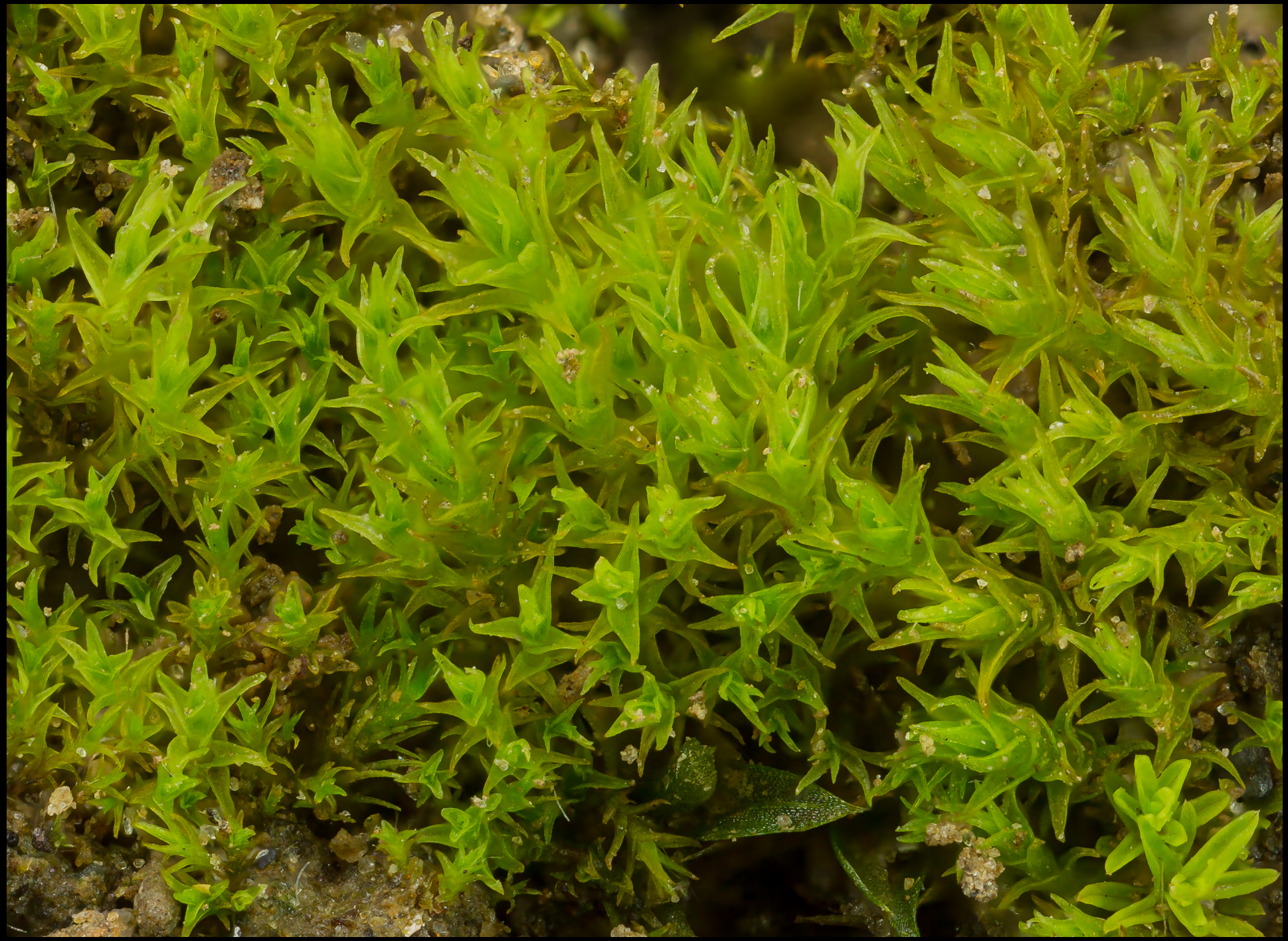


Groves

U

Uncommon

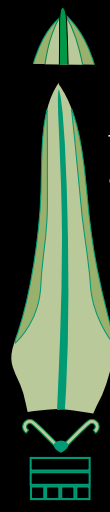
Microscope needed



Leaves erect or spreading, tapering from a broad base, supposedly less folded and recurved than in *ferrugineus*.

DIDYMODON FERRUGINEUS Small, yellow-green moss with lanceolate recurved leaves that taper from broad bases, low papillae, and long cells of the costa exposed above; leaves arch downwards when wet.

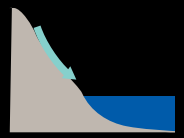
Small moss of limy soil and seeps, with sharply folded leaves that spring wide open when moistened. Long cells of costa exposed above, papillae low, hard to see.



leaves sharply folded and reflexed, tending to lie on their sides, springing open abruptly when moistened

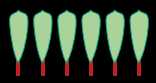
low papillae

elongate cells of costa exposed on upper surface



Rocks with seepage by water

Calcareous rocks or soil



Groves

U

Uncommon

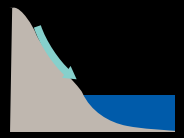
Microscope needed

Some leaves strongly arching and folded, others less so. It is what it is.

The leaves which flare to a broad base are typical of our Didymodons.

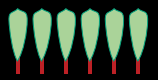
DIDYMODON RIGIDULUS Small, yellow-green moss with lanceolate recurved leaves that taper from broad bases, low papillae, and costa covered with short cells above and excurrent into a thickened point.

Small moss of limy soil and seeps, with leaves tapering from a broad base and the costa covered with short cells above and excurrent into a short blunt tip. The upper margins may be thickened. It seems that thickened tip should be visible in the photos, but it isn't.



Rocks with seepage by water

Calcareous rocks or soil



Groves

U

Uncommon

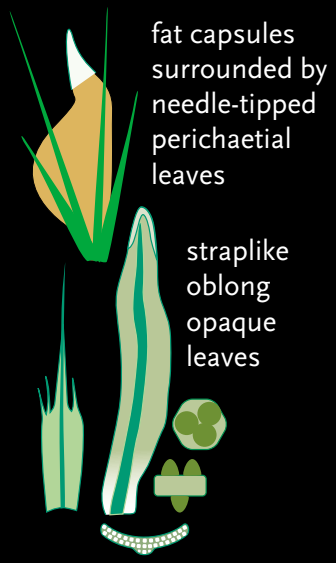
Microscope needed

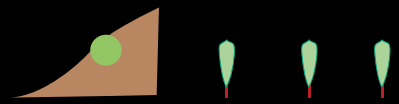
The tapering leaves with recurved edges are characteristic of *Didymodon*. *Barbula, Bryoerythrophyllum, Hymenostylium* and *Gymnostomum,* papillose genera that grow in similar places, have more parallel-sided leaves.

Like other small papillose mosses, the leaves of *Didymodon* look opaque and do not photograph sharply.

DIPHYSCIUM FOLIOSUM Papillose oblong vegetative leaves, large lopsided capsule surrounded by slender perichaetial leaves.

A small moss with large lopsided capsules, growing in small patches on bare shaded soil, particularly on banks at the edges of trails and streams and among tree roots. The vegetative leaves are oblong, blunt, and papillose; the capsules are stalkless, asymmetrical, and have white pleated peristomes of fused teeth. *Buxbaumia*, which has similar peristomes and is related, has capsules on stalks.





Must know

Microscope needed

Capsules surrounded by needle-tipped perichaetial leaves, in a turf of vegetative leaves, on mineral soil.

Outer peristome much reduced; inner peristome a white pleated membrane.

DISTICHIUM CAPILLACEUM Small moss making turfs in limy seepage; leaves with long clasping bases and slender tips, in two rows; capsules straight and erect.

Small northern moss with distinctive frond-like shoots. Leaves in two rows with clasping bases, like an iris, and long slender points; capsules erect, or mostly so. Makes dense turfs or small mounds on wet limy rocks. *D. inclinatum*, a related species, has curved capsules.

Calcareous seepage

Turf

R

Rare

Microscope needed

Leaves with long clasping bases and long slender tips, in two rows. Tiny and hard to photograph!

Often forms a dense turf or small dense mounds in limy pools or seeps. The setae were originally straight and got beat up in transit.

DITRICHUM Small or medium-sized mosses with slender leaves, often from a partly sheathing base; alar cells not inflated; capsules erect; peristome teeth split, partially or fully, into narrow papillose segments.

flexicaule

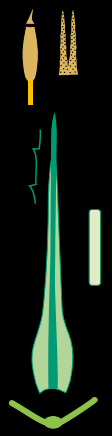
R

Rare

lineare

M

Must know



pallidum

F

Identifiable in field

C

Common in right habitat

Mostly common mosses of disturbed soil, with slender leaves and uninflated alar cells. Sterile plants look much like several other genera of disturbed soil, particularly *Dicranella*, *Bruchia*, *Pleuridium,* and *Trematodon*. Sometimes they can be identified; more often they can't or shouldn't. Fertile plants have long setae, small erect capsules, and papillose peristome teeth split into narrow segments. They are usually easy to identify; sterile plants are harder.

Lineare, *pallidum,* and *pusillum* (not shown) are common weedy species found in all sorts of open disturbed habits. *Lineare* usually has branches with short leaves, *pallidum* has a yellow seta, *pusillum* a reddish one. *Flexicaule* is larger, more northern, and more of an ecological specialist. It has a red or purple seta and a thatch of red rhizoids at the base.

Open soil

Calcareous seepage

F

Identifiable in field

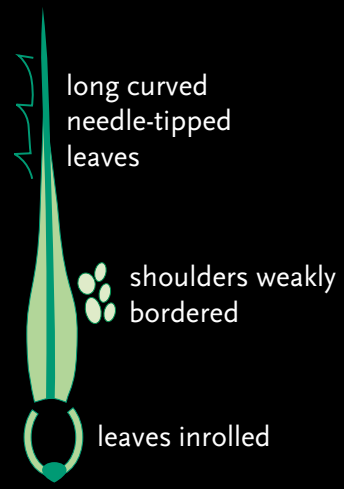
C

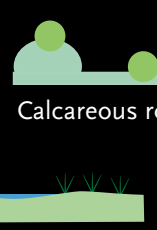
Common in right habitat

Microscope needed

DITRICHUM FLEXICAULE A large species with long soft leaf tips, recognized by the furry lower stems, the slender concave leaves with long needle tips, the undifferentiated alar cells, and the small obliquely oriented cells that form a weak border at the shoulders.

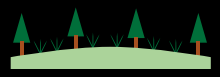
A northern species found on open calcareous rocks; often associated with intermittently flooded alvars or seeps, but also on dry ledges as well. Looks like a double-size *Dicranella heteromalla*; best identified by the inrolled leaves, undifferentiated alar cells, abundant rhizoids on the lower stem, and weak border of oblique cells along the lower margins. Fertile plants have erect *Ditrichum* capsules and dark red setae.





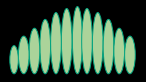
Calcareous rocks or soil

Alvars



Limy barrens

Turf



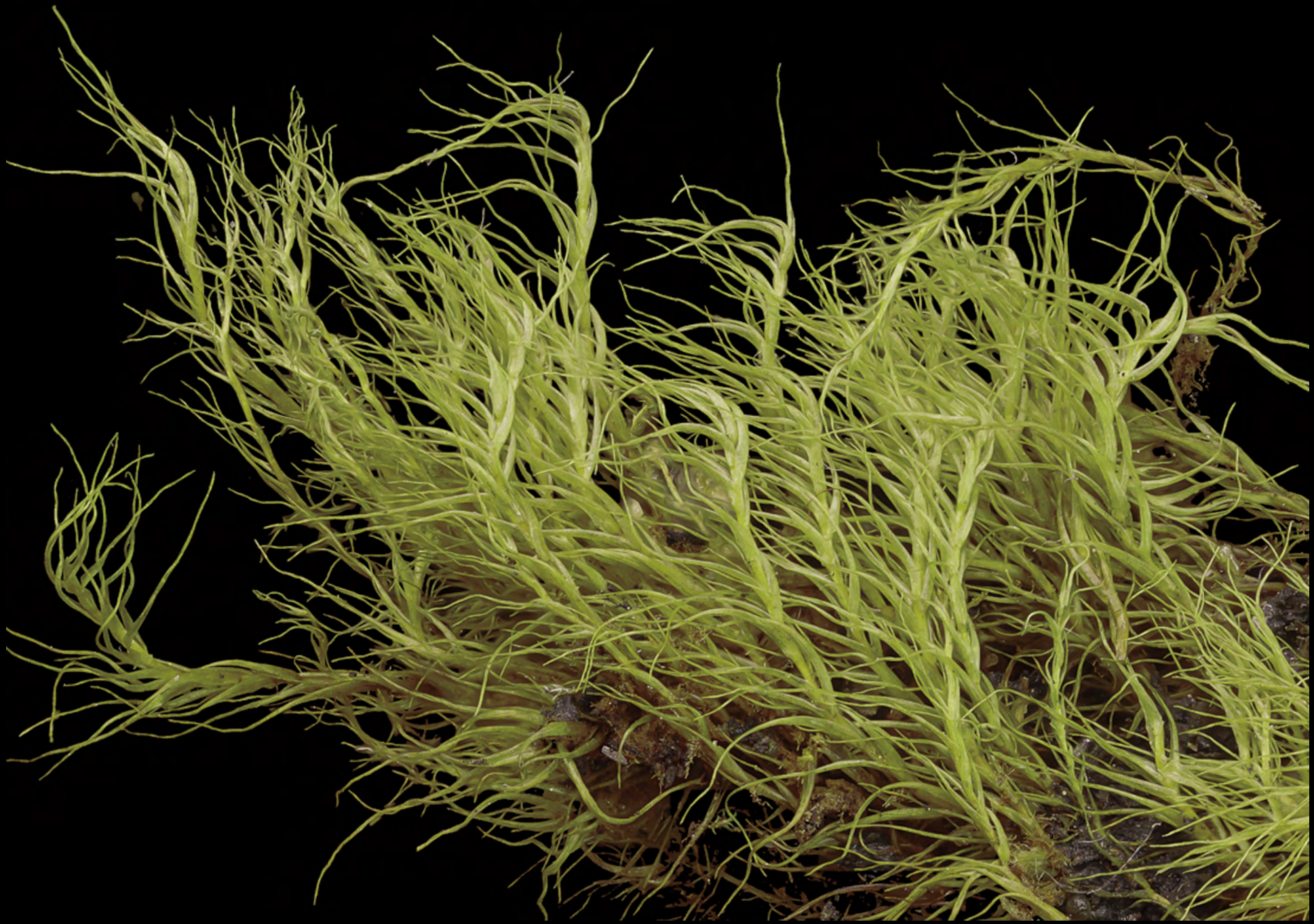
Loose mounds

R

Rare

Microscope needed

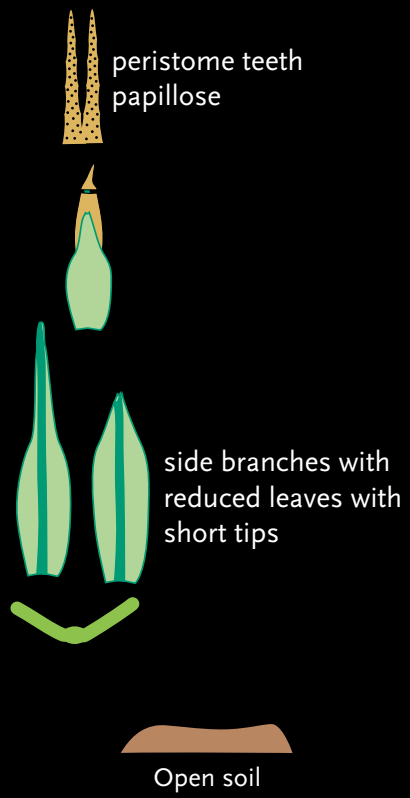
Leaves long, slender-tipped, curved, clasping the stems at their base; rhizoids abundant; plant dioicous, the males (right) with conspicuous perigonia.



Long slender curved leaves, sometimes secund. (From a faded specimen.)

DITRICHUM LINEARE Small moss with long leaves on its primary shoots and short blunt ones on secondary shoots. Often, as here, almost all the shoots have short leaves. Capsules erect, on long setae which turn red at maturity.

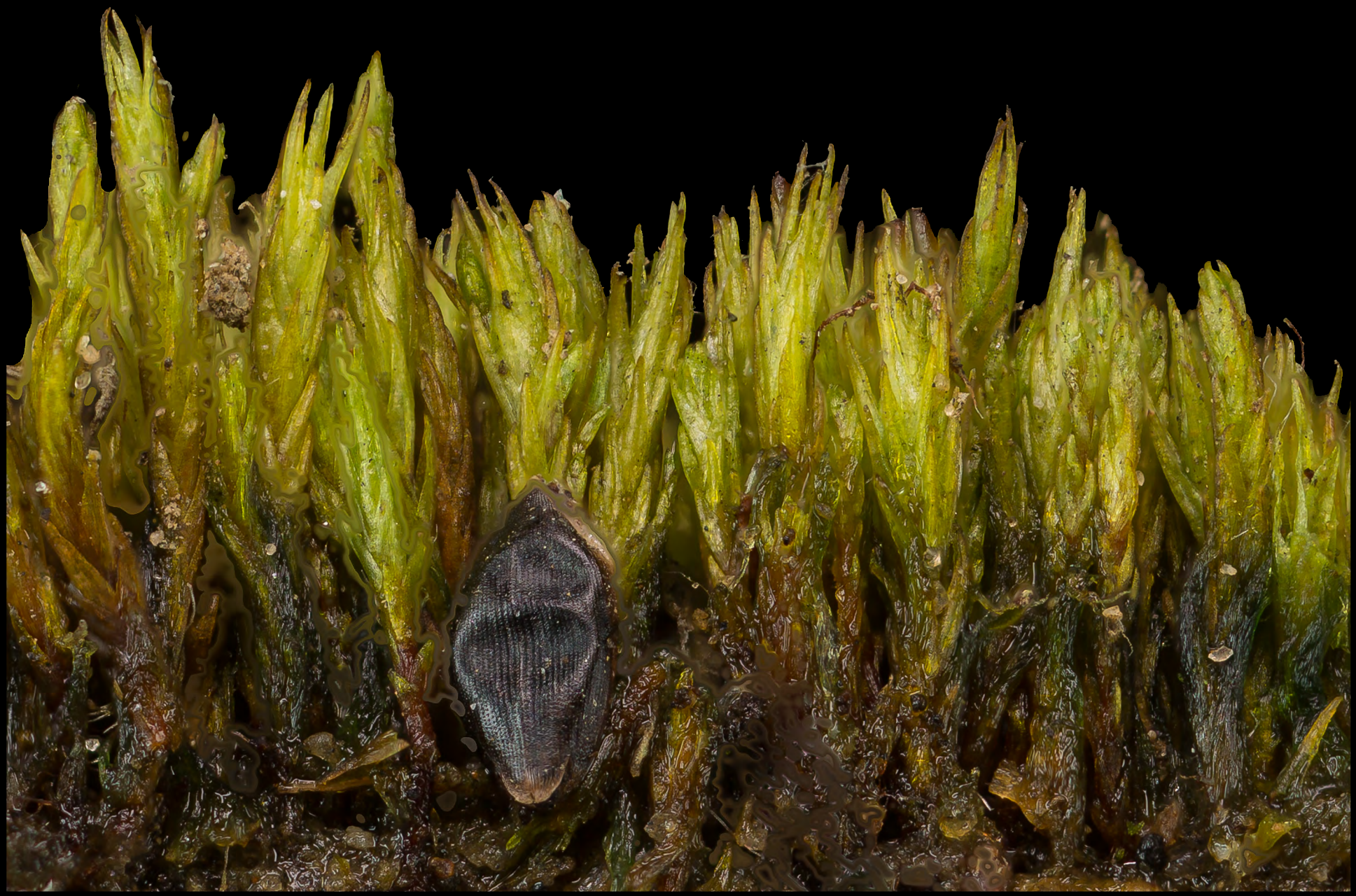
A tiny but very common moss, often covering large areas of open disturbed soil. Recognized by the short secondary stems with small blunt-tipped leaves and the capsules on long reddish setae.



M
Must know

Microscope needed

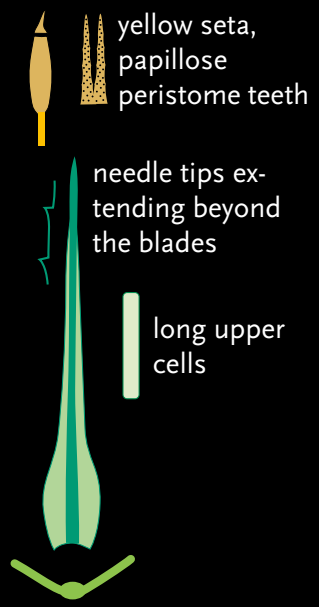
Long-tipped leaves on the primary shoots (right photo), shorter ones on the side shoots.



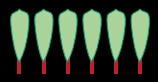
Often in low dense turfs on open wet mineral soil.

DITRICHUM PALLIDUM A small moss with slender leaves with long needle tips filled with the costa; capsules erect, setae yellow, peristome teeth papillose.

A common moss of fertile moist mineral soil, found in fields, tip-ups in the woods, and other disturbed places. The leaves are very long and silky, and have excurrent costas that make long needle tips and relatively long upper cells. The setae are yellow and the capsules erect. Sterile plants can easily be mistaken for *Dicranella heteromalla*. A lot of things can be easily mistaken for *Dicranella heteromalla*.



Open soil



Groves

F

Identifiable in field

C

Common in right habitat

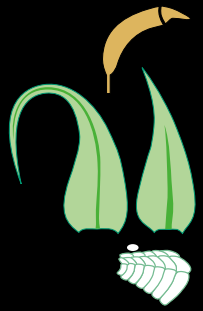
Microscope needed

Tufts of wispy light-green leaves with costas excurrent into long tips, on mineral soil.

DREPANOCLADUS ADUNCUS Slender costate leaves, usually with falcate-secund tips; alar cells greatly enlarged, extending to the costa; outer stems cells not enlarged, no rhizoid initials at leaf tips.

An aquatic or semi-aquatic moss, often attached to submerged wood, found in ponds, pools in wetlands, and intermittently submerged shores. Often in limy or at least minerotrophic water; seemingly replaced by *Warnstorfia* in soft water. Field appearance varies; it can be pinnate or irregular and have either straight or curved leaves.

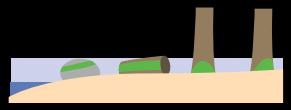
Formerly a common and not-very-fussy representative of a large genus: basically anything with costate falcate-secund leaves that lived in wet places was a *Drepanocladus*. Now, save for a few ignorable variants, the only one left. Recognized in the field as part of the "*Drepanocladus* group" by the slender costate leaves, usually curved, and as this species by the inflated alar cells and the lack of rhizoid initials or inflated stem cells. For the other members of the group see *Hamatocaulis, Limprichtia, Sanionia,* and *Warnstorfia*.



leaves often curved; alar cells much enlarged

Open wetland

Pond or lake



Intermittently submerged trees, shrubs, and wood

Trailing in water

C

Common in right habitat

Microscope needed

Pinnate branching, long slender leaves, usually falcate secund, usually green or brown but not red or gold.

Often messy.

Costa is hard to see without a microscope.

DRUMMONDIA PROREPENS A creeping moss with erect shoots, forming patches on tree bark; leaves lanceolate, with smooth cells and flat edges; capsules exserted; capsules short, without ridges.

Much darker in field than shown here.

A southern species, rare with us, that forms patches or traceries on the bark of deciduous trees. Leaves lanceolate, not curled when dry, with flat margins and smooth cells. Much resembles an *Orthotrichum*, but grows in lines or patches rather than clumps or tufts.

capsules exserted

leaves lanceolate with flat edges

Trees

Thick doormat

F Identifiable in field

R Rare

Microscope needed

Erect shoots with tightly overlapping leaves, from creeping horizontal stems.

Radiating patches generated by creeping stems; on sugar maple bark, with *Frullania eboracensis.*

The creeping stems of *Drummondia*, mixed with clumps of *Orthotrichum* and *Ulota*.

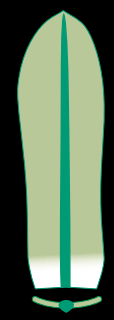
ENCALYPTA Medium-sized or small, with opaque papillose yellow-green leaves on short stems; upper cells multiply papillose with c-shaped papillae; lower cells enlarged, clear, with heavy cross walls; calyptra tubular, narrowed to a beak.

ciliata

R Rare

F Identifiable in field

procera



M Must know

rhaptocarpa

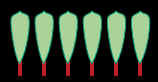
R Rare

F Identifiable in field

Three distinctive mosses found on limy soil or rocks with limy seepage. *Procera* is our common species, typically found in recesses in limy ledges that are at least intermittently wet. It is the largest of the three, has blunt vegetative leaves, and is rarely fertile. *Rhaptocarpa* is a small distinctive northerner with long needle tips on the leaves. We find it on limy ledges near water in the northern forest, and in limy barrens northward. *Ciliata* is a small rare species that resembles *procera* but lacks a central strand and is often fertile.

Calcareous seepage

Calcareous rocks or soil



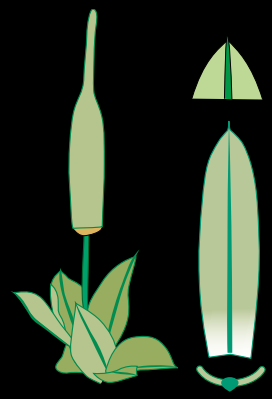
Groves

Turf

Microscope needed

ENCALYPTA CILIATA Small plants, vegetative leaves with tiny needle tips, central strand absent, often fertile.

A small northern species, rare with us, found in seepage cracks in calcareous rocks. Leaves with short needle tips, capsules often present, setae long, capsules smooth, stems without a central strand.



leaves with short needle tips

Thin doormat

Calcareous seepage

Calcareous rocks or soil

F Identifiable in field

R Rare

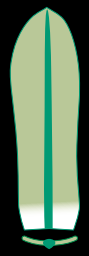
Microscope needed

Vegetative leaves with short needle tips; calyptras narrowed to a slender prophylactiform beak.

ENCALYPTA PROCERA Broad, rounded, yellow-green, papillose leaves, stems without a central strand, brood bodies often present.

Medium-sized mosses with relatively short stalks and oval or oblong, blunt, butter-colored leaves with multipapillose cells. The broad leaves separate it from other genera like *Barbula* with which it might be confused.

Procera is by far the commonest of our three *Encalyptas* and is usually found sterile. The distinguishing features of sterile plants are the blunt leaves, the stems without a central strand, and, when present, brown brood bodies in the leaf axils.



broad, blunt leaves

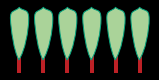
multi-papillose cells

c-shaped papillae

clear cells at base

Calcareous rocks or soil

Calcareous seepage



Groves

Must know

Microscope needed

Immediately recognized as an *Encalypta* by the butter color and short plants with broad leaves. A microscope is necessary to make sure this is *procera* and not *ciliata*.

Short stems, butter-green color, blunt vegetative leaves without needle points, forming groves; with *Anomodon rostratus.*

In a calcareous turf with *Gymnostomum aeruginosum*.

ENCALYPTA RHAPTOCARPA Small plants with long needle-tipped leaves, often forming dense mounds or a turf.

A far-northern species, distinguished from our other Encalyptas by the long needle tips on the vegetative leaves. Rare with us, on limy ledges in the spray zone of lakes and rivers. Common in limy barrens in the north, where it can form a turf with *Distichium and Ditrichum flexicaule.*

leaves with extended white hair tips; capsules ribbed

Calcareous seepage

Calcareous rocks or soil

Small cushions

Turf

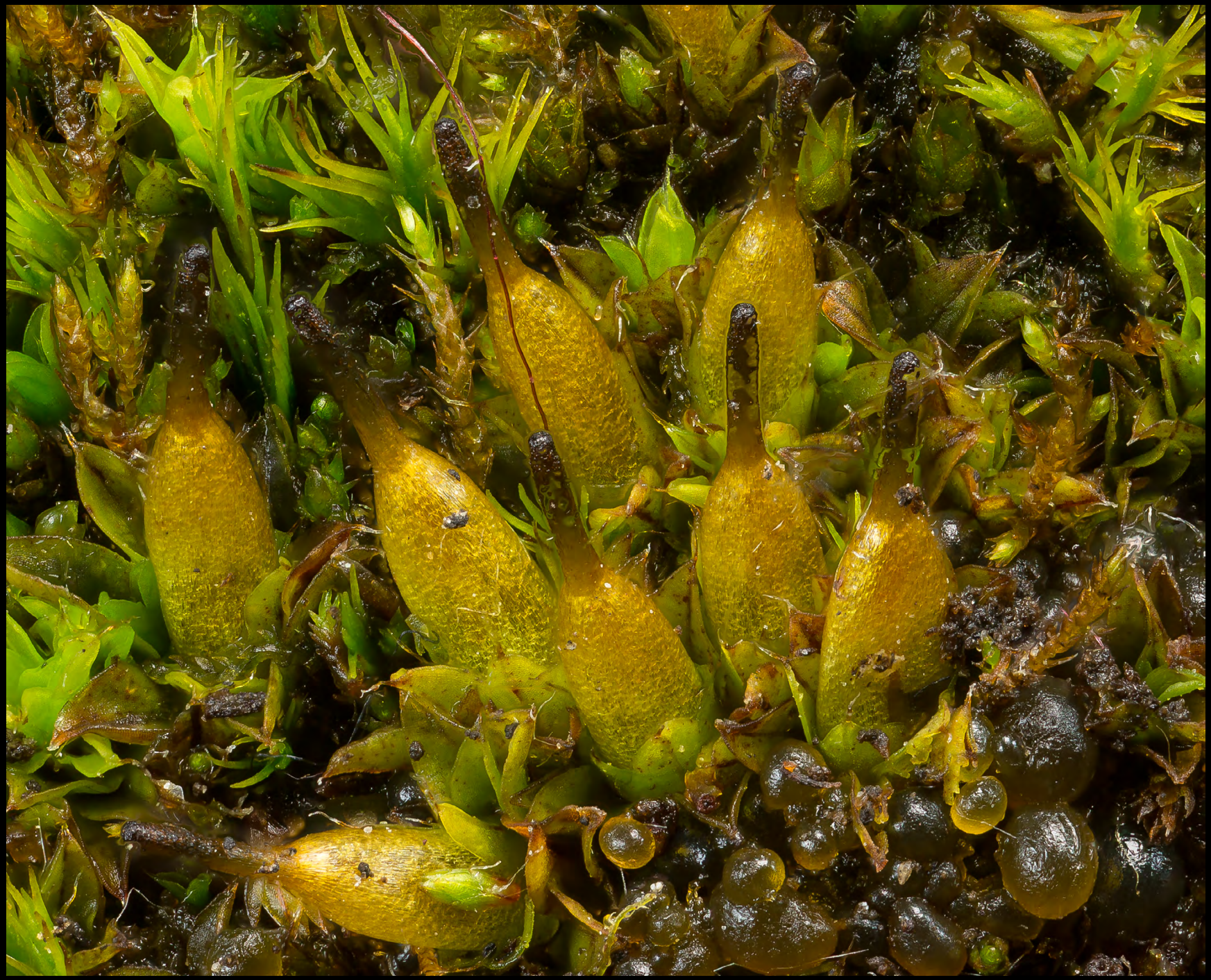
F

Identifiable in field

R

Rare

Microscope needed



Making a turf in crevices in a limy barrens; with *Distichium capillaceum* and *Nostoc.*

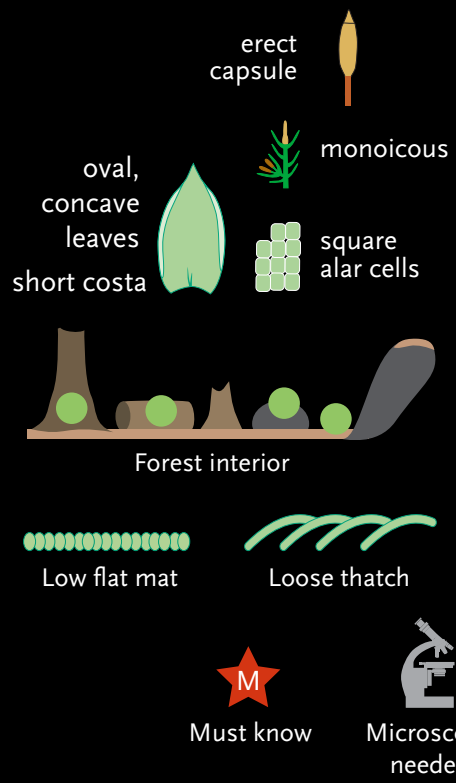
Long hair tips on the leaves, calyptras with thick beaks.

ENTODON Large common mosses of wood and stone; leaves broadly oval, concave, short-pointed, closely overlapping, with small square alar cells and short double costas; capsules erect, produced in large numbers.

cladorrhizans

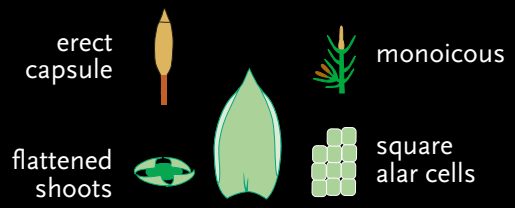
seductrix

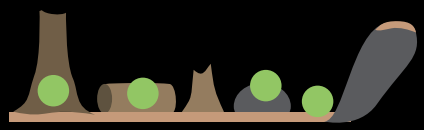
Two common mosses, abundant in open, second-growth woods in the oak zone, making loose thatches or mats on logs and tree bases and somewhat tighter mats on rocks. Shiny, flattened shoots with concave, inrolled, closely overlapping leaves with relatively short tips. The erect capsules, which are produced in large numbers, are a good field mark. Our two species differ macroscopically in whether the shoots are round (*seductrix*) or flattened (*cladorrhizans)* and microscopically in the number of alar cells and the roughening of the peristome teeth. *Callicladium haldanianum* also has concave overlapping leaves and can have somewhat flattened branches; its leaves are less tightly overlapped and have long tips and inflated alar cells; its capsules are curved.



ENTODON CLADORRHIZANS Flattened, loosely pinnate branches with concave, inrolled, closely overlapping leaves; capsules erect.

A common species on trees and stones in second-growth woods. Branches strongly flattened, with distinct edges; leaves with 12 or fewer alar cells up margins; teeth of outer peristome mostly smooth.





Forest interior

Loose thatch

Must know

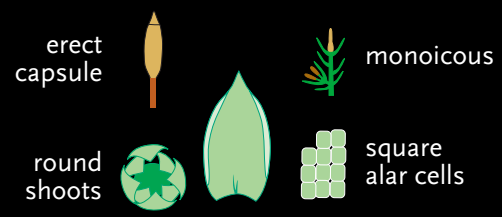
Microscope needed

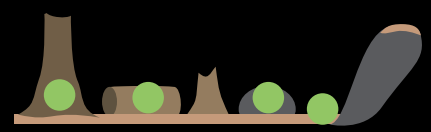
Loose mats, loosely pinnate branches, straight cylindrical capsules.

Flattened branches, closely overlapping leaves, the tips barely visible.

ENTODON SEDUCTRIX Round, loosely pinnate branches with concave, inrolled, closely overlapping leaves; capsules erect.

A common species in open deciduous forests in the oak zone, forming mats or loose thatches on rocks and soil, and often mixed with other mosses (*Brachythecium, Hypnum, Thuidium*...) on logs. Much like *Entodon cladorrhizans,* but the branches round in section or somewhat compressed instead of strongly flattened. The shininess and the rounded branches are good field marks, but you have to know what to look for. If it has compressed branches without distinct edges it is *seductrix.* If it has strongly compressed branches with distinct edges it is *Cladorrhizans.* The worm moss *Bryoandersonia,* another round-branched oak zone species, is larger, has costate leaves with slender tips, and grows on soil.





Forest interior

Loose thatch

M

Must know

In a flattened mat on a rock.

On tree bark, a stringier form, showing the round branches. The tiny plant under the *Entodon* is likely *Leskea sp.*

Rounded branches, concave leaves, straight capsules.

On a dry stone in a wall, March 2020; fairly dense mats; erect cylindrical capsules often abundant; yellows in late winter.

Short, cylindrical, somewhat wormlike branches; becoming pinnate at the free ends.

EPHEMERUM CRASSINERVIUM A tiny hard-to-photograph moss that grows from a persistent bright-green protonema.

Ephemerum is a small genus of tiny stalkless mosses with sharply toothed leaves and round capsules that grow from a persistent protonema of branched filaments. We have four northern forest species which are separated microscopically. *Crassinervium,* shown here, has costate leaves with papillose upper cells.

plants minute, stalkless

leaves sharp toothed, from a persistent green protonema

Open moist fertile soil

Protonemal mat

R

Rare

Microscope needed

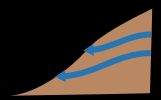
Dense mat of protonemal filaments; scattered plants with slender, toothed leaves and small round capsules.

EURYNCHIUM Small mosses with irregularly pinnate growth; leaves oval, toothed, costate, not closely overlapping; stem leaves wider than the branch leaves; upper cells short, alar cells small and square.

Two small mosses found near the ground on wood and soil. They have oval leaves with sharp teeth that are loosely spaced, upper cells that are much shorter then the middle ones, and some differentiation between branch and stem leaves. Often the branches spread and form a loose canopy. In the field they look much like *Bryhnia* or a small loose-leaved *Brachythecium*. The short upper cells are the key.

hians

pulchellum



Seepy bank

Moist soil and wood near forest floor

U

Uncommon

Microscope needed

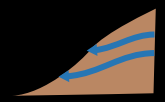
C

Common in right habitat

Microscope needed

EURYNCHIUM HIANS Small moss with short-tipped leaves, in loose mats. Branch leaves uniformly sharp-tipped, setae papillose.

A small moss with a southern distribution, found on moist soil, often where there is seepage. The toothy leaves and short upper cells make it a *Eurynchium*. The papillose setae and uniformly sharp tips of the branch leaves make it this species.



Seepy bank

Loose thatch

U

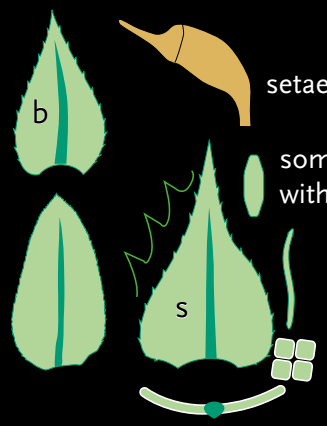
Uncommon

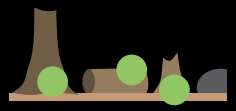
Microscope needed

With *Plagiomnium ellipticum*; oval, toothy leaves; branch leaves all sharp.

EURYNCHIUM PULCHELLUM Small moss with oval, toothed leaves with short upper cells. Branch leaves vary from sharp to rounded. Setae smooth.

Small unprepossessing moss forming loose thatches or mats in shady wet places, often mixed with other mosses. Recognized as a *Eurynchium* by the toothy leaves and short upper cells and as this species by the presence of some branch leaves with rounded tips and the smooth setae.





Moist wood and soil near the forest floor

Loose thatch

C

Common in right habitat

Microscope needed

Leaves concave, short-tipped, spreading, not tightly overlapping; in loose thatches; setae smooth.

Often fertile.

FISSIDENS Flattened fronds in which each leaf has a pocket that clasps the bottom edge of the leaf below.

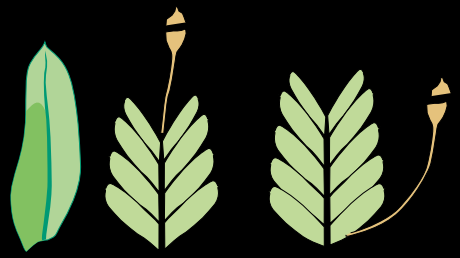
A large genus, varied in size and leaf shape, but always with flattened shoots with the leaves in two rows, and always with a pocket on the upper edge of the leaf which clasps the lower edge of the leaf above. Found commonly in moist shaded places: on limy rocks, in swampy ground, on wet ledges, and on soil. The species look alike and field identification is hard. A few of the species can be recognized in the field; most species require a microscope.

adianthoides

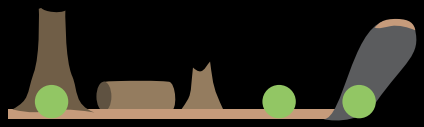
bryoides

bushii

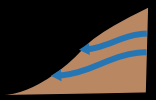
dubius



Leaves in two rows, with pockets along their upper edges



Tree and ledge bases, mineral soil in forests



Seepy bank

Erect fronds

Arching fronds

fontanus

osmundioides

subbasilaris

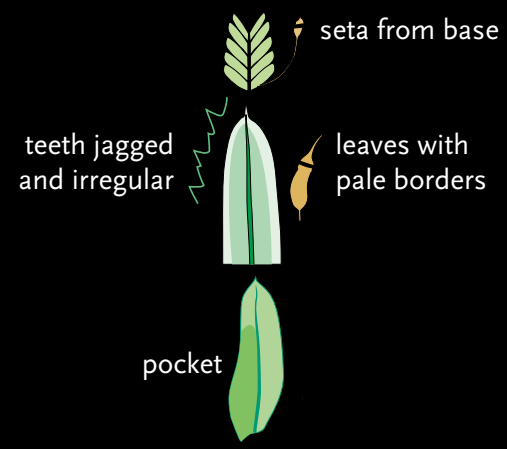
taxifolius

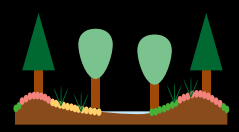
Must know

Microscope needed

FISSIDENS ADIANTHOIDES Large species with jagged teeth; borders pale, cells flat rather than bulging, in a single layer.

A large showy species of wet woods, swamps, seepy ground. Identified presumptively by the large size and pale border. Confirmed by the jagged teeth and the angular cells that don't bulge.





Swamp

Arching fronds

C

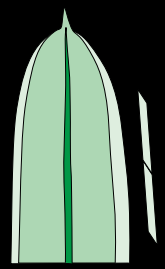
Common in right habitat

Microscope needed

Large fernlike shoots; leaves with a faint pale border.

FISSIDENS BRYOIDES Tiny species with leaves bordered by long cells, setae from the tip of the plant, and red peristome.

A tiny species, hard to see unless it is fruiting, common on intermittently submerged rocks in stream channels, also on limy boulders. The small size is a good clue; the setae from the tips of the shoots, red peristomes, and bordered leaves are proof.



leaves with a border of long cells

Calcareous rocks or soil

Rocks by water

Erect fronds

F

Identifiable in field

C

Common in right habitat

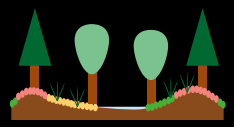
Microscope needed

Shoots only a millimeter or two high, with five to 10 leaves; always on rock, often in streams.

Often found on small stones or cobbles; hard to see when not in fruit.

FISSIDENS BUSHII Small plants; leaves with low rounded teeth; cells of the pocket with several papillae.

A small species of moist soil and rock bases in woods and thickets, often among vegetation or mixed with other mosses. Leaves with low regular teeth; costa ends at the leaf tip; cells of pocket with several papillae, best seen in cross sections. *Taxifolius* is similar but has an excurrent costa and pocket cells with single papillae.



Moist woods

Arching fronds

U

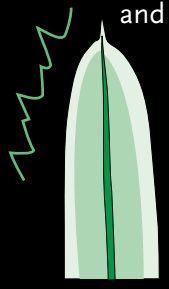
Uncommon

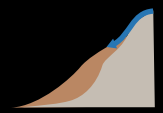
Microscope needed

Other than being small and growing on soil it has few field characters.

FISSIDENS DUBIUS A medium-sized species with pale borders and jagged, irregular teeth, resembling *adianthoides*; cells small, with bulging faces, sometimes overlapping or two-layered.

A common species of rocks and moist soil, often in seeps or the splash zones of streams. In the field, the pale borders suggest either *dubius* or *adianthoides*. Under the microscope, the small bulging cells that occasionally overlap each other identify *dubius*.





Dirty wet ledges

Rocks by water

Arching fronds

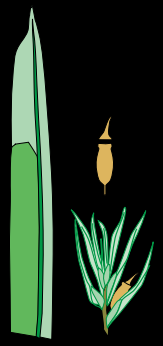
C

Common in right habitat

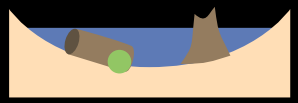
Microscope needed

FISSIDENS FONTANUS An aquatic with long slender leaves that are widely spaced and don't clasp.

An aquatic found on submerged wood in ponds, often associated with variable water levels. The leaves are long and slender and clasp when they are small but are separated at maturity. The pockets are hard to see, and it looks a lot like *Leptodictyum* in the field.



long slender leaves that don't clasp each other



Submerged wood

Trailing in water

F

Identifiable in field

R

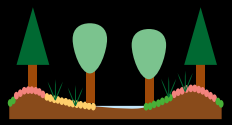
Rare

Skinny plants, trailing in water, limp when exposed.

FISSIDENS OSMUNDIOIDES Medium-large species with small even teeth, smooth (not papillose) cells, and the costa ending several cells below the tip.

A conspicuous species, resembling *dubius* in the field but lacking the pale borders and with the setae from the tips of the shoots. Identified microscopically by the low even teeth and the costa that stops just below the tip.

Rocks by water



Swamp

Arching fronds

C

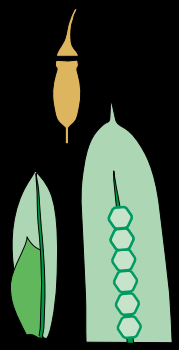
Common in right habitat

Microscope needed

This plant was from soil at the base of cold mountain ledges with calcareous seepage.

FISSIDENS SUBBASILARIS Small plants, often dark green or brown, making dense mats; costa covered with small round cells.

An uncommon species of limy rocks, sometimes making large mats. Plants small, often dark; upper costa covered with small round cells.



costa covered with round cells

Calcareous rocks or soil

Low flat mat

U

Uncommon

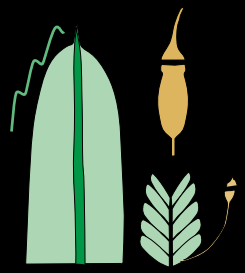
Microscope needed

FISSIDENS SUBBASILARIS

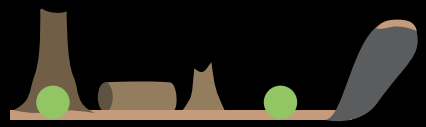
In dark thin mats on shaded marble.

FISSIDENS TAXIFOLIUS Small plants with low even teeth and the costa excurrent as a short tip; cells of pocket with single papillae.

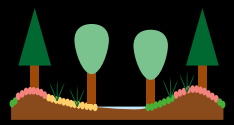
Small plants, resembling *bushii*, and like it found on the ground in moist woods, often among vegetation or other mosses. Distinguished by the combination of low even teeth, excurrent costa, and pocket cells with single papillae. In older blanks the costa can be brown.



small; setae from base of fronds; low even teeth; costa sticks out at tip; cells of the pocket with a single papilla



Tree bases, mineral soil in forests



Swamps

Thin doormat

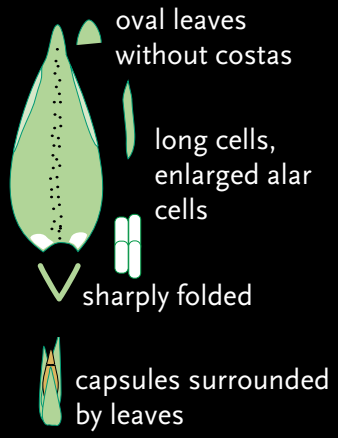
U

Uncommon

Microscope needed

FONTINALIS ANTIPYRETICA Large, dark, aquatic moss with sharply folded leaves in three rows.

Our commonest aquatic moss, found attached to rocks and submerged wood in lakes, rivers and streams, and also stranded and growing partially erect on mud flats. Large plants, often long and trailing, dark green except for the new growth, with sharply keeled leaves in three rows. This is our only species of *Fontinalis* with keeled leaves. The other species are much less common and much harder to identify.



Rocks in streams

Trailing in water

M

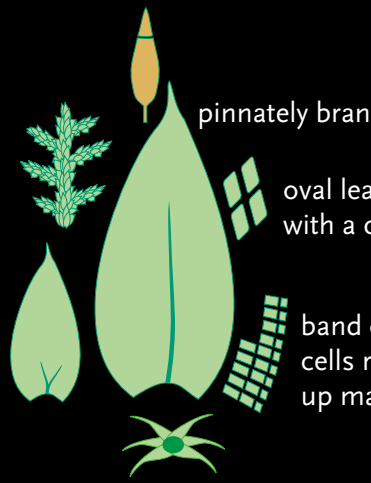
Must know

elongate,
sparsely branched

keeled leaves
in three rows

FORSSTROEMIA TRICHOMITRIA Flattened shiny pinnate moss making shaggy fringes on rocks and trees; branches somewhat flattened; leaves costate, upper cells diamond shaped, band of alar cells run up the margins.

A southern moss, rare with us, that makes coat hooks or fringes on trees and limy rocks. The flattened branches and oval costate leaves with a band of alar cells running up the margins are distinctive. *Leucodon* (which is only on trees) is similar but has round branches, ecostate leaves, and is less branched.



Limy rocks, trees

Coat hooks

F

Identifiable in field

R

Rare

FORSSTROEMIA TRICHOMITRIA

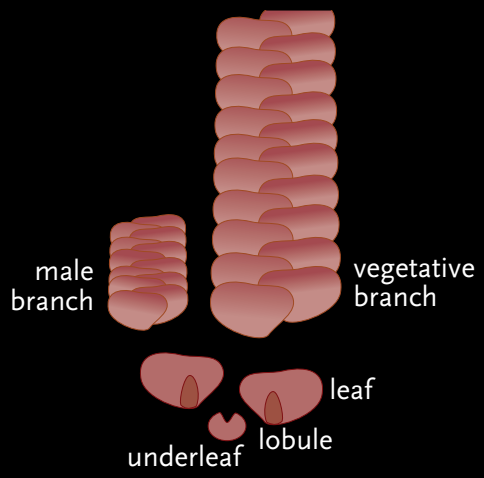
Resembles *Leucodon* but costate and much more branched.

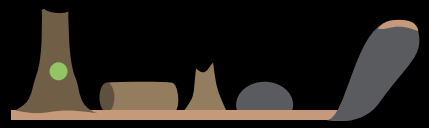
FORSSTROEMIA TRICHOMITRIA

FRULLANIA ASAGRAYANA Small liverwort of tree bark; larger and less tightly attached than *Frullania eboracensis*, often red, with a line of enlarged cells in the middle of the leaf.

FRULLANIA EBORACENSIS Small, dark, liverwort making thin, tight mats on tree bark; leaves overlapping with front ends up and without enlarged cells (ocelli) in center.

Small, dark, liverwort, variously green, red, or black, making thin mats or traceries of individual stems on the bark of hardwoods. With *Ulota* and *Platygyrium,* one of the commonest epiphytes in our area. Other species, generally bigger or redder or differing in some other way, can occur, and are separated microscopically by details of the leaves and leaf cells.





Forest interior

Low flat mat

Must know

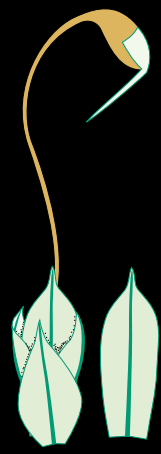
Microscope needed

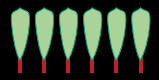
A typical mat, on sugar maple.

vegetative branch
male branch

FUNARIA HYGROMETRICA Small moss of open disturbed soil; plants budlike; setae curved; capsules pear shaped, curved, asymmetrical.

One of our commonest short life-cycle mosses, sometimes covering large areas of open soil in the spring. Leaves oblong oval, concave, with large clear cells and the costa entering the short tip. Capsules unique: pear shaped, asymmetrical, sometimes upside down, on curved setae. *Aphanorrhegma*, *Physcomitrella*, and *Physcomitrium* have similar leaves.





D
Locally dominant

M
Must know

Budlike plants, curved setae, capsules often upside down.

GRIMMIA Dense, dark cushions on rocks; leaves often with white hair tips, perichaetial leaves not much enlarged.

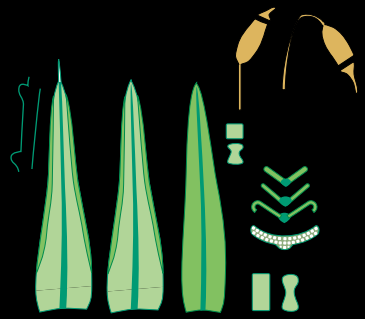
donniana

muehlenbeckii

A common genus of small dark mosses, often with conspicuous white hair tips, that make dense cushions on exposed rocks. The cushions are more compact and the plants much less branched than *Racomitrium,* which grows in the same habitats.

Grimmias are typically small, thick-walled upper cells, without papillae, and few or no teeth; the costas are said to be homogenous, without stereids. Other leaf features vary and are used for species identification.

Schistidium, a closely related genus formerly included in *Grimmia*, has stereids in the costa, enlarged perichaetial leaves, and a columella that is shed with the lid of the capsule. Determining sterile plants of either genus is necessary but quite hard.



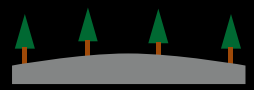
lanceolate leaves, often with needle tips or recurved edges, short smooth cells (no papillae) that are often thick walled or have concave sides

olynei

pilifera

unicolor

Rocks by water



Rocky or sandy barrens

Acid ledge

Alpine zone

Large cushions

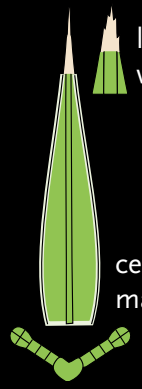
Must know

Microscope needed

GRIMMIA DONNIANA Leaves keeled, often with white hair tips; upper margins thickened, cells on lower margins elongate; capsules above leaves.

The common high-elevation *Grimmia* in the northern forest. Recognized presumptively in the field by the exserted capsules and leaves with white needle tips; confirmed by the keeled leaves with thickened upper edges and long cells along the lower edges. Similar plants found on rocks in Adirondack lakes may be *donniana* or the closely related *incurva*.

capsules above leaves



leaves keeled, with long points

cells on lower margins elongate

Rocks by water

Alpine zone

Large cushions

Common in right habitat

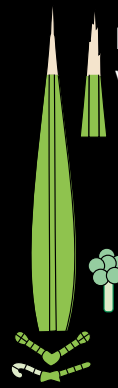
Microscope needed

Long white needle tips, capsules above leaves, setae mostly straight (this one is damaged).

Grimmia donniana, or possibly the related *incurva*, on boulders in the splash zone of Ampersand Pond, Adirondacks.

GRIMMIA MUEHLENBECKII Small plants with keeled, needle-tipped and ball-shaped gemmae near the bases of the leaves.

A small *Grimmia* that makes low mounds or mats on boulders, ledges and stones in walls. The leaves have short white tips, and balls of gemmae that originate from enlarged cells near the leaf base. The gemmae are diagnostic for *muehlenbeckii*. The related *Grimmia hartmanii* has gemmae near the leaf tips.



leaves keeled, with white points

stalked ball-shaped gemmae near the bases of the leaves

Boulders, ledges

Small cushions

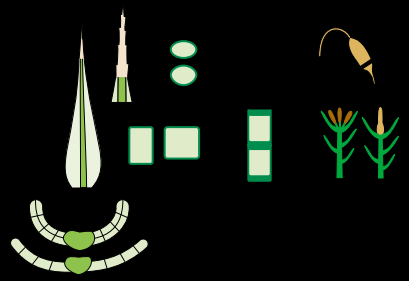
R

Rare

Microscope needed

GRIMMIA OLYNEI Concave leaves which are bistratose above and have white hair tips; capsules exserted on a bent seta.

Locally common on exposed rocks near streams and lakes. Easily recognized from the curved setae when fertile and, with more difficulty when sterile, by the concave leaves which are bistratose above and have white needle tips. Usually found on ledges near rivers, uncommon overall but sometimes locally common.



Concave leaves, bistratose above, exserted capsules on curved setae

Rocks by water

Large cushions

F Identifiable in field

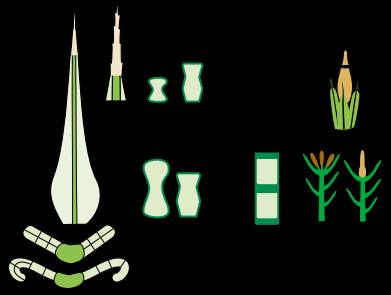
U Uncommon

Microscope needed

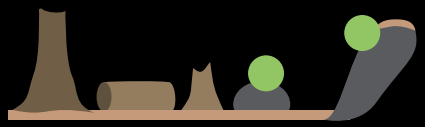
Concave leaves, long hair points.

GRIMMIA PILIFERA Long white hair tips, immersed capsules, keeled leaves that are bistratose above.

The commonest *Grimmia* in the central Appalachians, locally common in the northern forest on dry exposed rocks at low and middle elevations. Distinguished by the keeled leaves, long white hair points, and immersed capsules. *Grimmia donniana,* a common high elevation species, looks similar in the field but has enlarged basal cells that extend up the margins and exserted capsules.



leaves keeled and bistratose above, with long points, capsules immersed



Shaded boulders, ledges

Acid ledge

Large cushions

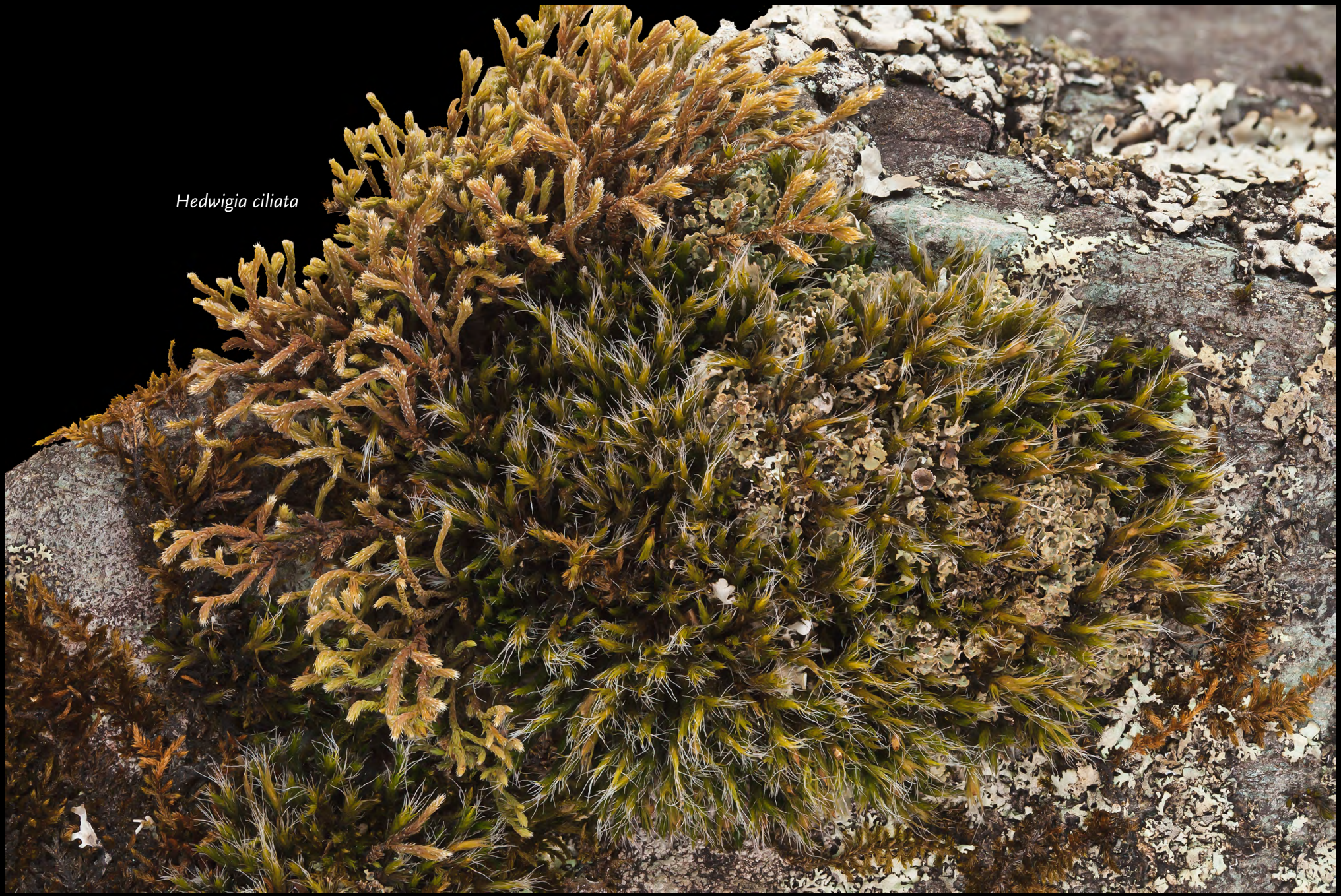
F

Identifiable in field

C

Common in right habitat

Microscope needed

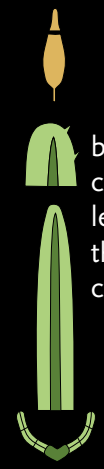


With *Hedwigia ciliata* and *Cladonia* lichens on exposed rocks.

Moist clump, with *Hedwigia ciliata* in the upper right corner.

GRIMMIA UNICOLOR A small, nearly black *Grimmia* found in the splash zone of rivers and streams; leaves blunt-tipped, several cells thick.

A small distinctive northern *Grimmia* that makes low mats or mounds on rocks by water, either in the high-water channel or in the splash zone. Distinguished by the concave leaves that are several cells thick in the upper parts and have blunt tips. *Schistidium* grows in the same places and can look similar in the field. Check for the blunt multistratose tips.



blunt, concave leaves with thickened canoe-tips

Rocks by water

Small cushions

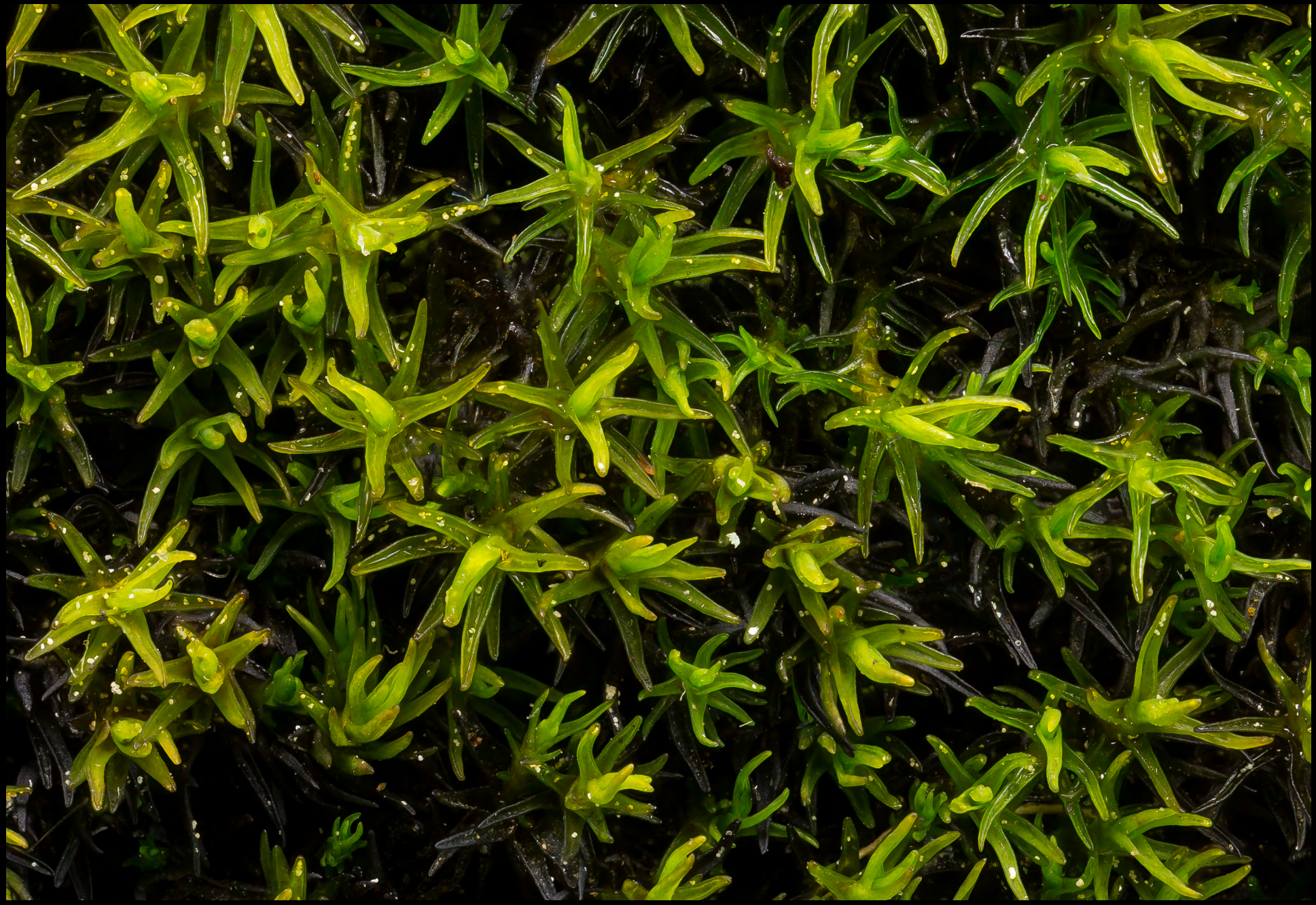
Low flat mat

U

Uncommon

Microscope needed

Blunt, thick concave tips, dark older leaves.



GYMNOSTOMUM AERUGINOSUM Small moss with slender lance-linear leaves, forming mats or cushions; leaves with flat edges and broad tips; lower cells clear, upper cells with multiple papillae; upper side of costa covered with short cells.

A small light-green moss that makes mats, cushions, or mossicles on limy rocks, especially where there is seepage. Leaves are narrowly lanceolate, folded, opaque, curly when dry. Hard to tell in the field from *Amphidium, Barbula, Hymenostylium,* and *Rhabdoweissia*. The critical characters are microscopic: leaf edges flat; costa ending in the tip and covered with short cells above; multiply papillose cells above, clear cells at base; stems with a central strand.

Calcareous seepage

Small cushions

Mossicle

Low flat mat

Common in right habitat

Microscope needed

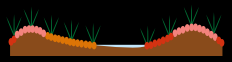
Small plants, often in dense tufts; tips short, old leaves not reddish.

Leaves light green, opaque when dry, only slightly tapered.

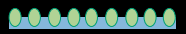
In a low turf with *Bryum sp.*, *Mnium marginatum*, *Encalypta procera*, and probably *Anomodon attenuatus*.

HAMATOCAULIS VERNICOSUS Large moss with costate, falcate-secund leaves; alar cells and outer stem not inflated, stem without a central strand.

A large, locally abundant moss of limy fens, often brown or reddish, with falcate-secund leaves. Resembles *Limprichtia, Warnstorfia* and *Drepanocladus,* and can grow with them. Distinguished microscopically by negatives: no inflated stem cortex, no inflated alar cells, no rhizoid initials near the leaf tips, no stem central strand.



Calcareous fen



Loose wet mat

D

Locally dominant

Microscope needed

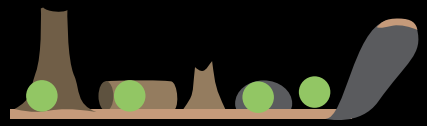
Sickle leaves, pinnate branching often golden brown or red brown.

Submerged in a rich fen, with bog bean.

HAPLOCLADIUM VIRGINIANUM Small, opaque, once-pinnate, yellow-green moss forming loose mats; all cells have single papillae.

A southern species, uncommon in the southern parts of the Northern Forest region. Resembling one of the small, once-pinnate, once-Thuidiums (*Abietinella, Rauiella, Cyrto-hypnum*) but more apt to be found on soil or acid rocks. (*Rauiella* grows on tree bases, *Abietinella* and *Cyrto-hypnum* on limy rocks or soil.) Under the microscope it is distinguished from *Thuidium* and its relatives by having single papillae on all cells. Compare *Heterocladium dimorphum*, a species of limy boreal forest which looks similar but has a short double costa.

once-pinnate, stems with paraphyllia, oval branch and stem leaves, cells with single papillae



Tree bases, wood, rocks, soil

Loose thatch

U

Uncommon

Microscope needed

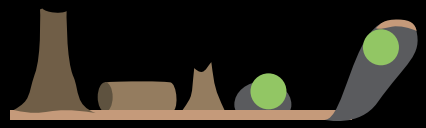
Wiry, once pinnate, yellow-green or brown; closer to the ground than *Abietinella* and the branches less tapering.

In loose, yellow-green or brown mats on soil and rocks; some or all of the plants with white tips are *Hedwigia*.

On basalt cobbles with *Hedwigia, Dicranum scoparium*, and early saxifrage.

HEDWIGIA CILIATA Large, stringy when dry, full when wet, concave, ecostate, papillose leaves with white needle tips.

A common and often dominant species of boulders and dry ledge crests. Gray-green, opaque, and skinny when dry, with the white needle tips conspicuous. Fuller and darker and glossy when wet, with the tips harder to see. Often with *Schistidium*, *Grimmia*, *Dicranum scoparium*, *Dicranum fulvum*, and *Polytrichum piliferum*.



Boulders, ledges

Loose thatch

D Locally dominant

M Must know

Wet plants, with lichens.

Dry and partially wet plants, on rocks, with *Dicranum* and strawberry.

Wet plants, with sedge leaves.

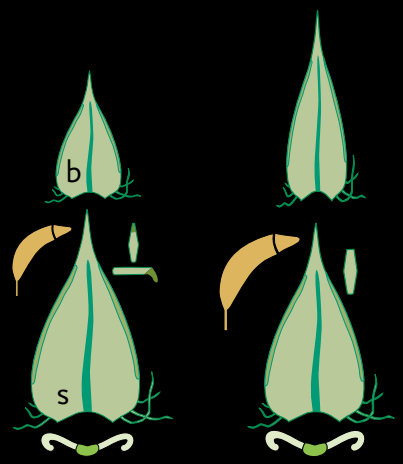
Wet plants, on a stone wall. It is abundant on dry rocks in the oak woods of eastern New York and western New England.

HELODIUM Wetland mosses with once-pinnate branching, broadly oval, costate stem leaves, and paraphyllia on the stems and leaf bases.

blandowii

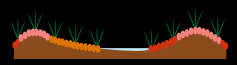
palustre

Medium-sized wetland mosses with oval costate stem and abundant paraphyllia. *Blandowii* is a conspicuous peatland species, easily identified by its bright color and regular branching. *Palustre* is a more cryptic species of minerotrophic swamps, identified presumptively in the field and confirmed with the microscope.



blandowii *palustre*

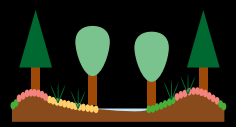
oval, costate stem leaves with recurved edges; paraphyllia on stems and leaves



Calcareous fen

F Identifiable in field

C Common in right habitat



Swamp

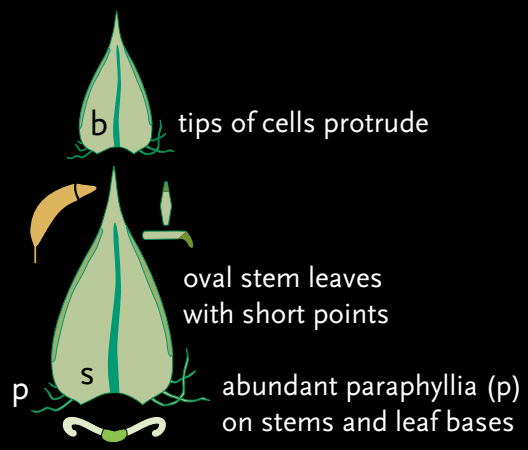
F Identifiable in field

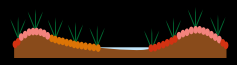
U Uncommon

HELODIUM BLANDOWII Large, bright yellow-green, regularly and stiffly pinnate, with abundant paraphyllia; leaves oval, costate; leaf cells protrude at tips.

paraphyllia in axils and on bases of stem leaves

A distinctive moss that grows erect in rich fens, often with *Tomentypnum, Calliergonella, Hamatocaulis, Scorpidium, Sphagnum warnstorfii,* and other fen species. Stems erect, stiffly and regularly pinnate, with abundant paraphyllia; cells protrude at tips.





Calcareous fen

Erect fronds

F Identifiable in field

C Common in right habitat

paraphyllia in axils and
on bases of stem leaves

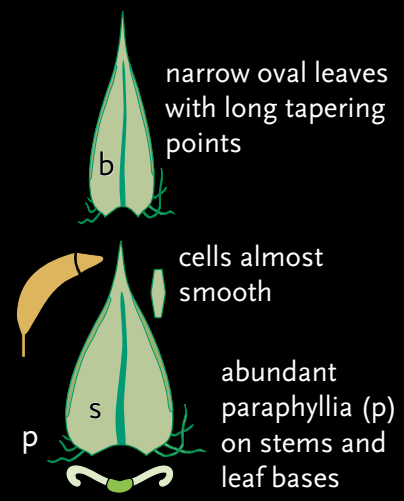
Yellow-green, stiffly pinnate, broad-oval stem leaves with paraphyllia.

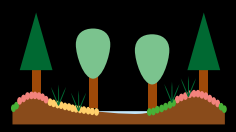
Green, yellow, or brown; with *Thuidium recognitum* and *Aulacomnium palustre*.

In successional thickets on a disturbed gravel terrace with limy seepage.

HELODIUM PALUSTRE Smaller species, often in the shade, with less regular branching, narrower leaves with longer tips, and cells barely projecting.

A southern species, uncommon in minerotrophic swamps. Smaller, less yellow, and less regularly branched than *blandowii*, with narrower leaves with longer tips and smooth or nearly smooth cells. The paraphyllia, which can be seen in the field (on a good day, with a good lens) are the key. It doesn't look like all that much, and the microscope helps.





Swamp

Loose thatch

Identifiable in field

Uncommon

Microscope needed

Long-tipped leaves, abundant rhizoids.

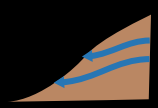
Pinnate branching, slender shiny costate leaves, abundant rhizoids.

HERZOGIELLA Two species of small shiny mosses with somewhat flattened shoots and narrowly oval, leaves that spread widely and have long tips, short double costas, and teeth to the base; outer cells of stem inflated.

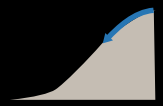
striatella

turfacea

Two forest mosses with wide-spreading, strongly toothed leaves with short costas and long tips, and stems with the outer cells inflated. *Striatella* is common and reasonably conspicuous on shaded banks and dirty ledges. *Turfacea* is smaller, apparently less common, and found on rotting wood. *Striatella* is identifiable in the field; *turfacea* takes a guess and a microscope.



Seepy bank



Wet ledge

Locally dominant

Must know

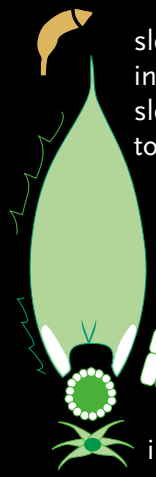
Logs, tree bases

Uncommon

Microscope needed

HERZOGIELLA STRIATELLA Small moss with slender long-tipped leaves that spread widely; costa short and double; shoots slightly flattened; alar cells inflated and decurrent; outer stem cells inflated.

A common moss of moist shaded banks, recognized in the field by the small size and the slender, wide-spreading, loosely arranged leaves that have long tips and the inclined capsules that appear in abundance early in the spring. Sterile plants resemble *Taxiphyllum* and *Pseudotaxiphyllum* and can grow with them; good microscopic characters are the inflated alar cells, inflated stem cortex, and toothed margins.



Thin doormat

Locally dominant

Must know

Shoots weakly flattened, leaves wide spreading wet or dry, with long wavy tips.

Often in dense turfs on ledges and banks; new capsules, with red setae, abundant in spring.

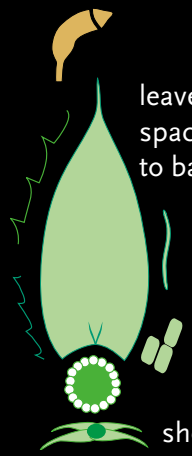
Shoots weakly flattened, leaves slender, well-spaced, with long wavy tips.

The well-spaced, narrow leaves give the shoots a sawtooth appearance.

Sawtooth shoots, abundant capsules appearing early in spring.

HERZOGIELLA TURFACEA Small moss with flattened shoots, and widely spaced leaves with long tips; leaves toothed to base; outer stem cells enlarged; a few enlarged alar cells.

A small species of logs and tree bases, similar in size to *striatella* but with more flattened shoots and with only a few inflated alar cells that don't run down the stem. Similar in the field to *Taxiphyllum, Pseudotaxiphyllum, Isopterygiopsis* and others; microscopic characters are essential.



Logs, tree bases

Low flat mat

U

Uncommon

Microscope needed

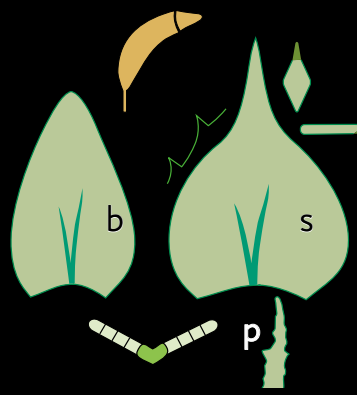
Flattened shoots in low mats or thatches on wood; spreading leaves with long slender tips; with *Bazzania trilobata*.

Much like a flattened version of *striatella* found on wood.

Capsules common in spring.

HETEROCLADIUM DIMORPHUM Small, papillose, once-pinnate moss; branches only slightly tapered; wet leaves spread widely; dry leaves show long curly tips; costas short and double; cells protrude at their tips.

Small rare northern species of limy soil and rocks in boreal habitats. Resembles *Abietinella* or a once-pinnate once-*Thuidium* in the field, but with branches that don't taper much and leaves that spread widely when wet and have long slender tips. With a microscope, the short double costas and protruding cell tips are definitive.



protruding cell tips

heart-shaped stem leaves with long slender tips and double costas

Calcareous rocks or soil

Loose thatch

Low flat mat

F

Identifiable in field

R

Rare

Microscope needed

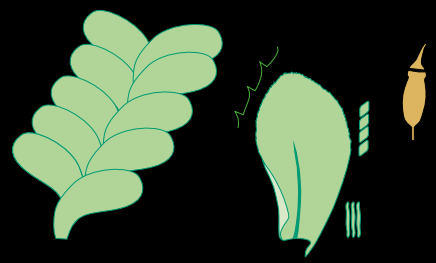
Once pinnate, with broad, wide-spreading leaves with long slender tips.

Opaque leaves, stiffly pinnate shoots; with *Plagiochila porelloides* and (small) *Campylium stellatum*.

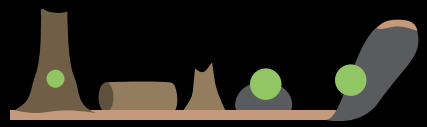
Leaves widely divergent when wet. *Abietinella* and *Haplocladium* do not do this.

HOMALIA TRICHOMANNOIDES Shiny, golden, flattened shoots, blunt rounded leaves.

A small but distinctive species, in thin mats on shaded rocks and occasionally trees, often but not always in calcareous situations. Fronds shiny, golden, and flattened; leaves blunt, tongue-shaped. Looks like a shiny liverwort with a costa.



flattened fronds, blunt, oblong, curved leaves



Boulders, ledges, sometimes trees, in the shade

Low flat mat

Flat fronds

U

Uncommon

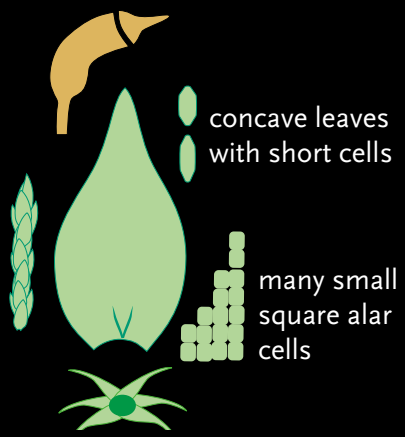
M

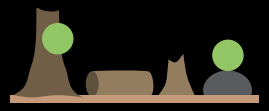
Must know

Mats are often tangled and messy; color and shininess are distinctive.

HOMOMALLIUM ADNATUM Small moss in thin flat mats, dark dull in the center, bright and shiny at the growing tips. Leaves oval and concave, with short costas; middle cells short, alar cells small and square, running up the margins.

A common but inconspicuous moss of rock and wood, making thin mats. Recognizable by shiny new growth and the spoon-shaped leaves. *Hypnum pallescens* has longer tips and is more regularly branched (and has teeth); *Amblystegium* has flatter, more pointed leaves with strong costas; *Pterigynandrum* is dark and dull; *Platydictya* is tiny.





Rocks, trees

Low flat mat

Must know

Microscope needed

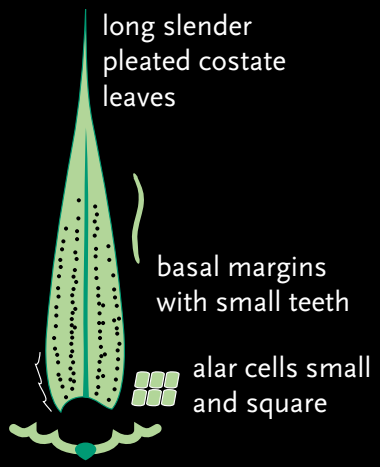
Stems creeping, leaves concave, almost parallel to stems.

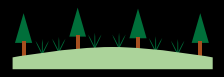
Older leaves brown, younger leaves bright yellow-green, tightly overlapping in budlike branch tips.

Often on small dry rocks; thin mats, the inner parts brown and sparse, the tips full and green.

HOMOMALOTHECIUM SERICEUM Distinctive moss: irregularly pinnate, long slender pleated leaves, toothed near the base; small square alar cells; only Newfoundland.

The only eastern North American representative of the genus, found in Europe and Newfoundland. Medium-sized, bushy, long-leaved, found in bogs, heaths, and barrens. The long pleated leaves with small teeth and alar cells are distinctive. *Tomentypnum nitens* has similar leaves but is regularly pinnate and is a fen plant.





Limy barrens

Open bog

Small cushions

F Identifiable in field

M Must know

Microscope needed

HYGROAMBLYSTEGIUM TENAX Small and stringy; oval leaves with broad costas, sharp points, short cells, and undifferentiated alar cells.

Common mosses of rocks in the spray zones and channels of streams. May make large mats or grow mixed with other species. Stringy, irregularly branched, with oval leaves with short cells and broad costas. Sometimes found away from streams. A weak segregate from *Amblystegium,* differing only in the wetter habit and the broader costas. *Tenax* is our common species; *fluviatile* is similar but has an even broader costa and a blunter tip.

Rocks in streams

Rocks by water

Low flat mat

C
Common in right habitat

Microscope needed

Lance-oval leaves with sharp tips and strong costas.

Stringy stems with irregular branching, in thin mats; leaves well separated.

Often tangled.

HYGROHYPNUM Mosses of seepage and streams with concave leaves and short tips that tend to curve in one direction. Alar cells inflated or not; costas vary between and within species.

One of the commonest genera of rocks in stream channels, also found on wet ledges, and on boulders by intermittent streams in the woods. Recognized, to the extent that it is recognizable at all, by the combination of the aquatic or semiaquatic habit and concave leaves with short, broadly acute or rounded tips that tend to point in one direction. The species, except the most striking, are identified microscopically.

duriusculum

U

Uncommon

eugyrium

C

Common in right habitat

Rocks in streams

Low flat mat

ochraceum

C

Common in right habitat

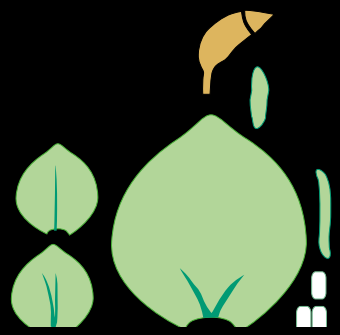
subeugyrium

R

Rare

HYGROHYPNUM DURIUSCULUM Broadly oval leaves with blunt tips and a few strongly enlarged alar cells; costas single or double.

A medium-sized species of rocks in brooks, recognized by the broadly oval leaves with blunt points and a few inflated alar cells. Often grows low in the channel, permanently submerged, making fringes on rocks or submerged wood. The rare *H. bestii*, not shown, is similar but has long cells along the margins.



leaves broadly oval; costa single or double; a few alar cells strongly enlarged

Rocks in streams

Low flat mat

F Identifiable in field

U Uncommon

Microscope needed

Broad concave leaves with blunt tips.

Often permanently submerged and crusted with silt and algae.

HYGROHYPNUM EUGYRIUM Concave leaves with hooded tips, short double costas and inflated alar cells. Stem with a central strand, the outer cells not inflated.

One of the commonest species in woodland streams, with oblong hooded leaves, short costas, inflated alar cells and yellow basal cells between the alar cells and costa. *Sematophyllum marylandicum* is very similar but has flatter leaves without hooded tips, no colored basal cells, and stems without a central strand.

oblong hooded leaves

short double costa

alar cells inflated

outer stem cells thick walled, central strand present

Rocks in streams

Loose thatch

Low flat mat

C

Common in right habitat

Microscope needed

Concave, oblong, hooded leaves, tips turned in one direction.

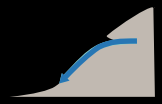
Loose shaggy mats, old stems brown, capsules common.

Common on wet cliffs and in the channels of intermittent streams where it makes brown mats of old stems with new green tips.

Forming dark skirts on the lower parts of a rock in a shaded brook; with *Brachythecium plumosum*.

HYGROHYPNUM OCHRACEUM Pointed concave leaves with strong costas, turned in one direction; inflated alar cells and outer stems cells.

A common species, resembling *Eugyrium* but with more pointed leaves with strong costas and both the alar and outer stem cells inflated. Makes shaggy mats on rocks in streams, in cascades, and on wet ledges.



Seepy ledge

Rocks in streams

Loose thatch

C

Common in right habitat

Microscope needed

Slender leaves, tips turned in one direction, irregularly branched.

HYGROHYPNUM SUBEUGYRIUM Concave leaves, similar to *Eugyrium,* but with broader tips with fine teeth, small square alar cells, and no central strand.

A rare or poorly known species of rocks in brooks. Our pictures come from the Adirondacks. Small plants with the young shoots green and the older ones red brown; leaves with short double costas, falcate secund near the branch tips. Close to *eugyrium* but with broader apices that are often finely toothed, small square alar cells, and stems with a thick cortex and no central strand.

Rocks in streams

Loose thatch

R

Rare

Microscope needed

Stems dark or reddish below, green at tips.

HYLOCOMIUM Large conspicuous pinnately branched mosses with arching frondose shoots and abundant paraphyllia; stem leaves broadly oval, toothed, sometimes papillose, with single or double costas.

U

brevirostre Uncommon

R

pyrenaicum Rare

Large mosses with broadly oval or triangular leaves and arching fronds, found growing on or over rocks, logs, and soil in forests, often in large patches. The fronds, corresponding to a year's growth, originate in stepladder fashion from the fronds of the previous year. With familiarity, the species can all be identified in the field.

M

splendens Must know

U

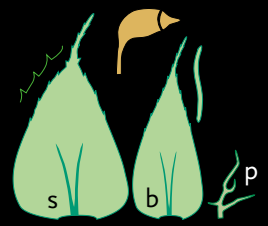
umbratum Uncommon

F Identifiable in field

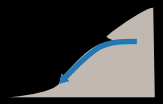
M Must know

HYLOCOMIUM BREVIROSTRE Large, full, and shaggy; twice pinnate; stem leaves rounded to their bases and abruptly pinched in to long tips; costas double.

A central-Appalachian species of moist shaded boulders and ledges with seepage, often in fertile deciduous woods or on calcareous soil. The fronds are twice-pinnate; the stem leaves are rounded at the base and pinched in just below the long skinny tip. *Pyrenaicum*, the species closest to it, is more northern and has a single costa and tips that are not pinched in.



stem leaves abruptly narrowed to long tips, costas double, small teeth



Seepy ledge

Shaggy fringes

F

Identifiable in field

U

Uncommon

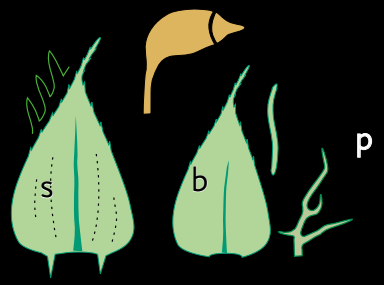
Stem leaves abruptly contracted to a skinny tip, somewhat pleated when dry.

New fronds originating from the backs of old.

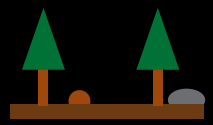
Making shaggy fringes on rocks.

HYLOCOMIUM PYRENAICUM Leaves strongly pleated, with spiny teeth and a single costa, decurrent at their bases.

Northern and rare, found on the floors of moist conifer forests. Strongly resembling *Pleurozium schreberi* and can grow with it. Recognized by the pleated leaves with spiny teeth and a single costa. Hard to find: Johanna Laggis discovered these in Hardwick, Vermont. *Umbratum* is similar but has slender branches and leaves that are toothed to the base and have double costas. *Pleurozium schreberi,* surprisingly similar, has shorter leaf tips and short double costas.



leaves pleated, decurrent at base, with spiny teeth to middle and a single costa



Boreal forest

Arching fronds

F Identifiable in field

R Rare

Microscope needed

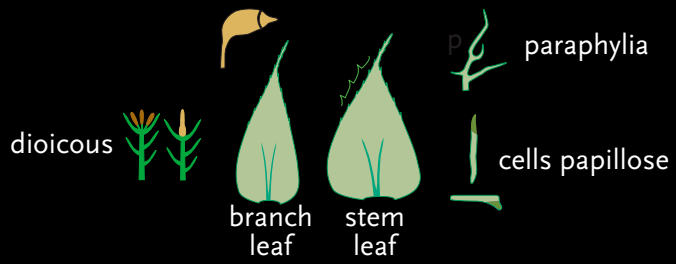
Red stems, pleated leaves with single costas and long tips.

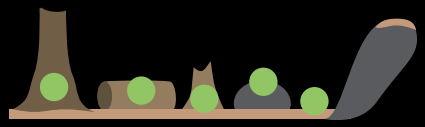
Paraphyllia on stems. *Pleurozium*, which is abundant in the same habitats, lacks paraphyllia and pleats and has short rounded leaf tips.

Growing in a tangle on the boreal forest floor, with a *Fissidens*.

HYLOCOMIUM SPLENDENS Horizontal, three-times pinnate fronds produced in a stepladder pattern.

An abundant moss of the ground layer of moist boreal forests, forming canopies over soil, rocks, old logs, and even growing up tree bases. The three-pinnate branching and stepladder growth are unique. Often grows mixed with the other ground-layer boreal coveralls: *Pleurozium*, *Ptilium*, *Dicranum*, and *Polytrichum*.





Boreal and mixed forest floors

Arching fronds

M

Must know

Stepladder growth, new frond coming from the old one.

A frond, consisting of one year's growth. The fronds are three-times pinnate or more, full rather than open, and form a curved or arching surface; the branches are mostly in the plane of the surface.

Stepladder growth, new frond coming from the old one.

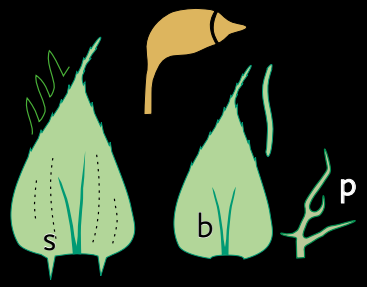
Stepladder growth, new fronds coming from the old ones; with *Dicranum polysetum*.

Arching fronds, forming a canopy.

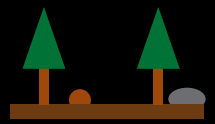
HYLOCOMIUM UMBRATUM Skinny, twice pinnate, skeletal looking plants with slender branches making somewhat three-dimensional fronds; stem leaves pleated, with double costas and spiny teeth to their bases, decurrent on the stems.

paraphyllia on stem

Uncommon and northern, found on rocks and logs in moist conifer forests and swamps. Looks much like a stringy, less pinnate version of *Hylocomium splendens* that hasn't filled out. Confirmed by the pleated, spiny-toothed leaves, mostly under 2 mm long, mostly with double costas.



branches 2× pinnate; leaves pleated, with spiny teeth to base; costa double; leaf base decurrent



Boreal forest

Arching fronds

F Identifiable in field

U Uncommon

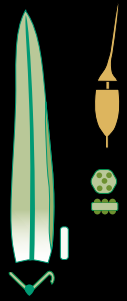
Microscope needed

Twice pinnate, branching three dimensional rather than planar, small leaves, looks stringy or skeletal.

HYMENOSTYLIUM RECURVIROSTRUM Small, papillose, leaves recurved below with a clear cell at tip, costa covered by long cells above and below.

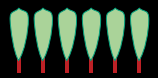
With the liverwort *Barbilophozia barbata*

A small moss with lanceolate, keeled, papillose leaves, growing in dense masses on cold, wet, limy cliffs. Often associated with *Myurella julacea*, which is threadlike and cylindrical, and *Gymnostomum aeruginosum* and *Amphidium sp.*, which are quite similar. A member of the Pottiaceae, and, like many of them, needs careful microscopic study.

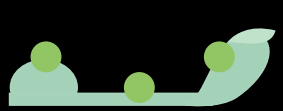


recurved lower edges, multipapillose cells, costa covered by long cells on both sides

Mossicle



Groves



Calcareous rocks or soil

Calcareous seepage

U

Uncommon

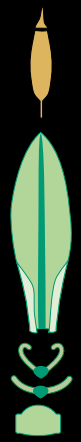
Microscope needed

Slender linear-lanceolate leaves with sharp tips. With *Barbilophozia barbata*.

Older leaves persist below current ones and can make a dense mat or thatch.

HYOPHILA INVOLUTA A small moss with blunt oboval or oblong leaves that roll up into tubes as they dry. Cells with low broad papillae.

A small uncommon moss of limy rocks, usually in stream channels, occasionally on ledges or boulders. Young plants are silvery; old plants may be blackish. The leaves are untoothed, have blunt tips (when unrolled!), and roll up into tubes as they dry. No other stream mosses look anything like it. The untoothed edges and cells with low papillae are good confirmations.



oval papillose leaves, rounded at their tips, that roll inwards from their edges, like a scroll, when they dry

Rocks in streams

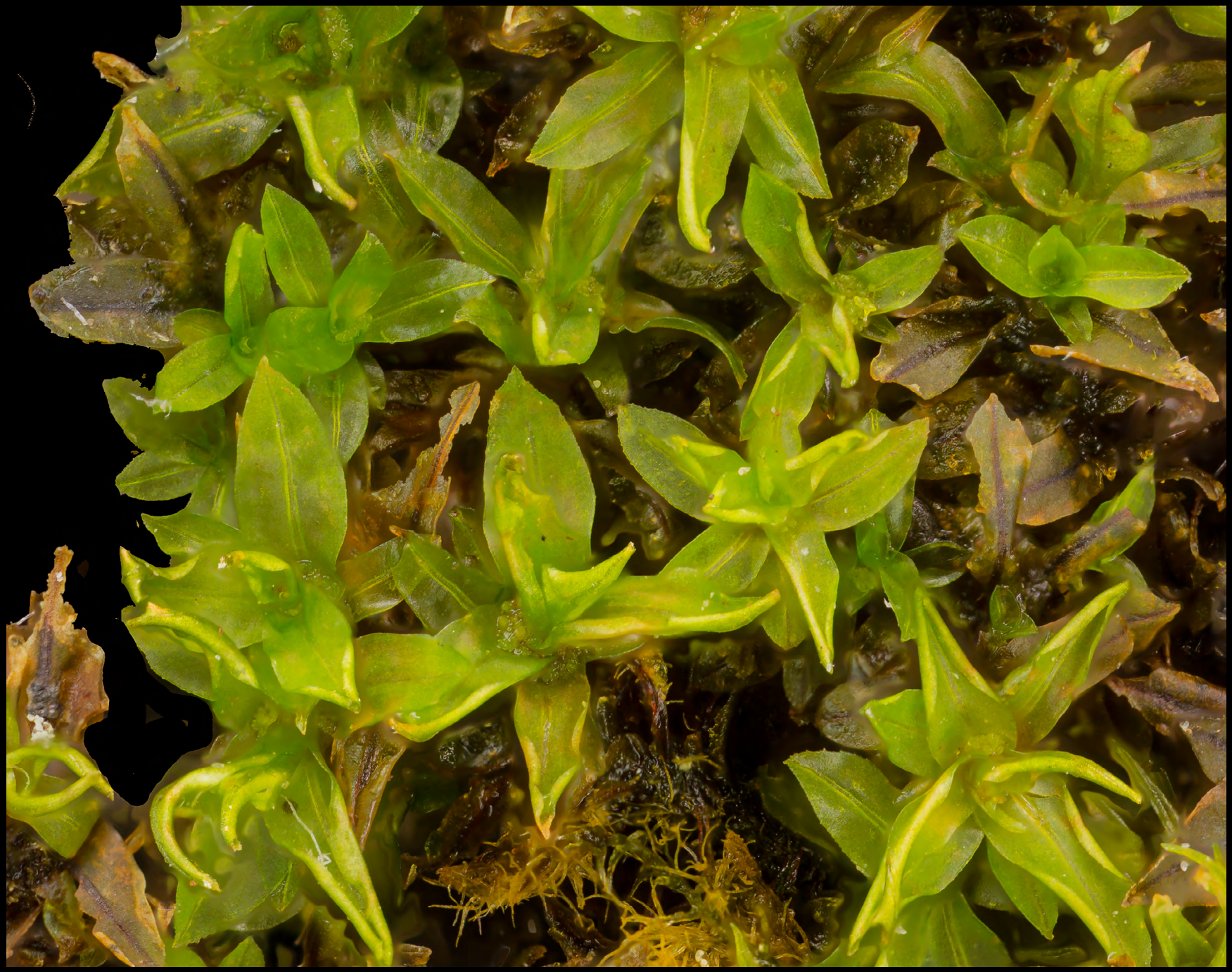
Small cushions

Turf

F Identifiable in field

U Uncommon

Microscope needed



Leaves rolling in from the edges and forming tubes.

Forming a turf, starting to roll.

Dry and rolled up.

cupressiforme

imponens

lindbergii

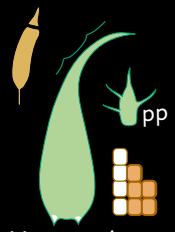
pallescens

A large genus, with four common species and at least as many rare ones. We show the commonest ones here. All have falcate-secund leaves with short double costas, long cells, and differentiated alar cells. The common species can be guessed at in the field, but because they are both similar and variable, confirmation is necessary. For rough and ready ID, note that *imponens* is large and the leaves are regularly arranged and look braided from above. It is a vigorous dominant that makes thick mats on logs in temperate forests and on everything in boreal forests. It also looks a lot like *Brotherella recurvans* and often grows with it. Guess first, and then check with the scope.

Lindbergii is also a big common species, found in all sorts of wetlands. Its leaves and branches are less regularly arranged than *imponens*, and it grows in clumps and mixed with other plants instead of covering large areas.

Pallescens is small and common, evenly branched and braided, on rocks and wood near the forest floor. It looks much like a half-size *imponens*; when in doubt, check with the scope. You have heard that before.

Cupressiforme is locally common on calcareous rocks inland and on trees and boulders in boreal forests near the coast. It is variable, but commonly looks like a slender stringy *imponens*. Since *imponens* can be slender and stringy when it wants, you always have to check.



Hypnum imponens

all species: falcate-secund leaves; long middle cells; differentiated alar cells; pseudo-paraphyllia at branch bases.

HYPNUM CUPRESSIFORME Slender, shiny, irregularly branched, often dangling; leaves weakly toothed; alar cells small, square, and opaque; pseudoparaphyllia, unlobed, their tips one cell wide.

A small, variable species with a very wide range, common along the Atlantic coast, uncommon inland. Local but not fussy; grows on trees, logs, soil, and limy and acid rocks. Often slender, stringy and pendant; other species, particularly *imponens*, can be too. The critical characters are the weakly-toothed leaves, small square alar cells, and unlobed pseudoparaphyllia with slender one-cell-wide tips.

Tree bases, logs, rocks

Loose thatch

Dangling

Uncommon

Microscope needed

Growing downward on a granite boulder in Maine; *Hypnum imponens* can do the same thing.

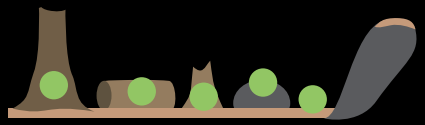
HYPNUM IMPONENS Large, regularly pinnate species with yellowish, inflated, alar cells and broad, often lobed pseudoparaphyllia.

An abundant species on logs and tree bases in deciduous forests, often making thick loose mats. Becoming locally dominant in dry boreal forest and covering large areas of the ground layer, irrespective of substrate. Often associated with *Thuidium* and *Brachythecium* on logs, and with *Pleurozium*, *Ptilium* and *Bazzania* in boreal forest. Easily recognized by its pinnate growth, sickle-shaped leaves, and large size and yellow-green color, but needs to be carefully separated from *Brotherella recurvans* (greener, a bit smaller, not as evenly braided) which often grows with it. *Hypnum pallescens* is usually smaller. Other *Hypnums* occur and can muddy the waters: critical identification depends on alar cells, stem cortex, and pseudoparaphyllia.

dioicous

broad pseudoparaphyllia, often lobed

large, thick-walled alar cells



Forest interior

Loose thatch

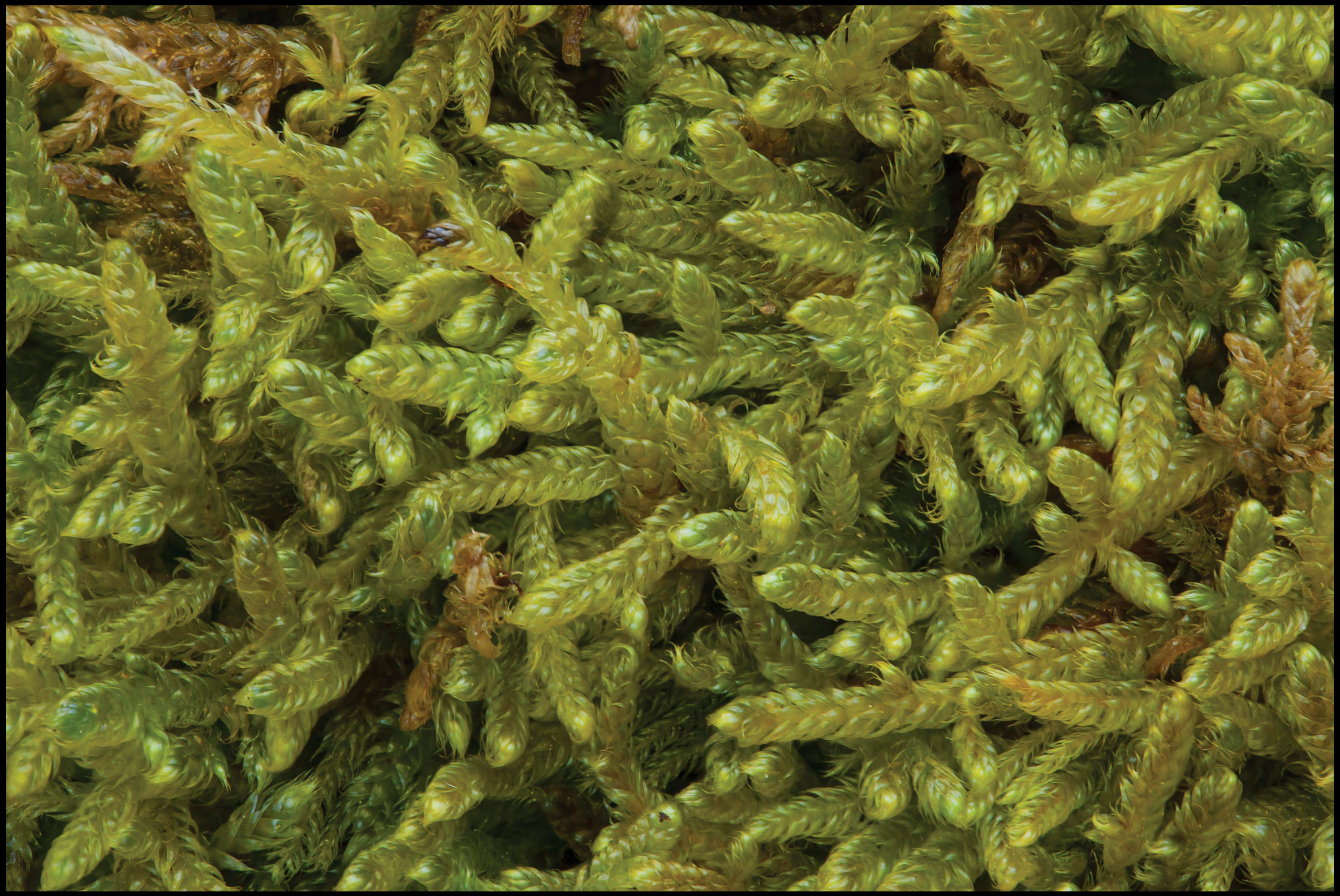
D Locally dominant

M Must know

Microscope needed

Medium size, pinnate branching, curved leaves, long tips curling one way.

In a thick mat; the branches with two rows of leaves look like braids.



Leaves shiny and slender, their tips tucked under the branches; shoots look braided from above.

Dry, growing downwards in a pendent mat. *Hypnum cupressiforme* does this as well, but is usually not this regularly pinnate.

In a dense mat on the floor of a boreal forest in Maine, with a few stems of *Pleurozium schreberi*. *Imponens* is a common dominant in moist boreal forest.

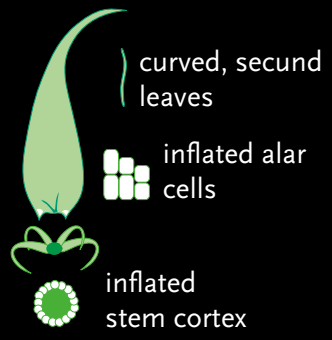
On a moist, rotting log.

On a fairly hard log that has lost its bark. Loose mats on top, pinnate traceries below.

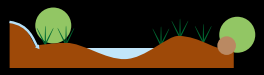
Mixed with *Bazzania trilobata* in a stream ravine in boreal forest on coast of the Bay of Fundy.

HYPNUM LINDBERGII Sickle-shaped leaves with short costa, alar cells and outer stem cells inflated.

The common *Hypnum* in wetlands and wet grassy places, found on lake and river shores, on rocks and logs in the splash zone, in wet lawns and meadows, and in hummocks in swamps. Recognized as a *Hypnum* by the curved, long-pointed leaves with a short double costa, and as *lindbergii* by the combination of irregular branching, strongly inflated alar cells and inflated stem cortical cells. Several rare species (*pratense, fertile, plicatulum*) also have inflated stem cortical cells and must be separated by leaf characters.



Pond or lake



Open wetland

Loose thatch

C

Common in right habitat

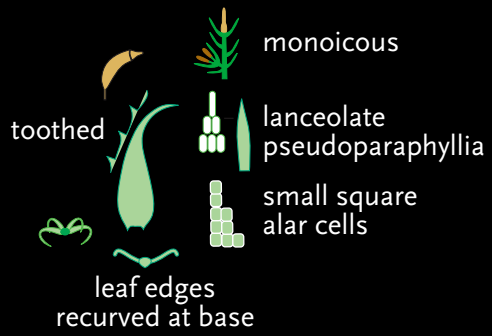
Microscope needed

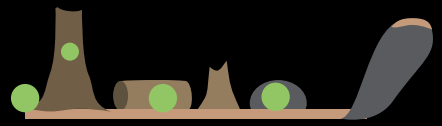
Curved, slender, secund leaves, irregular branching, wet habitat.

Often sparsely branched; the leaves are falcate secund but not as neatly braided as *imponens* or *pallescens*.

HYPNUM PALLESCENS Small, evenly pinnate, with slender, toothed leaves under 1 mm and small square alar cells.

A small and very common species of tree trunks, tree bases, logs and rocks, usually easy to recognize because of the combination of sickle-shaped leaves, braided appearance, and small size. *Hypnum imponens*, the other common *Hypnum* on wood, is twice as big. Other small species of bark are either stringier and less regular (*Platygyrium, Amblystegium, Leskea*...) or, if pinnate (*Rauiella*) are not falcate secund and do not look braided.





Tree bases and trunks, logs, boulders, mostly in shade

Low flat mat

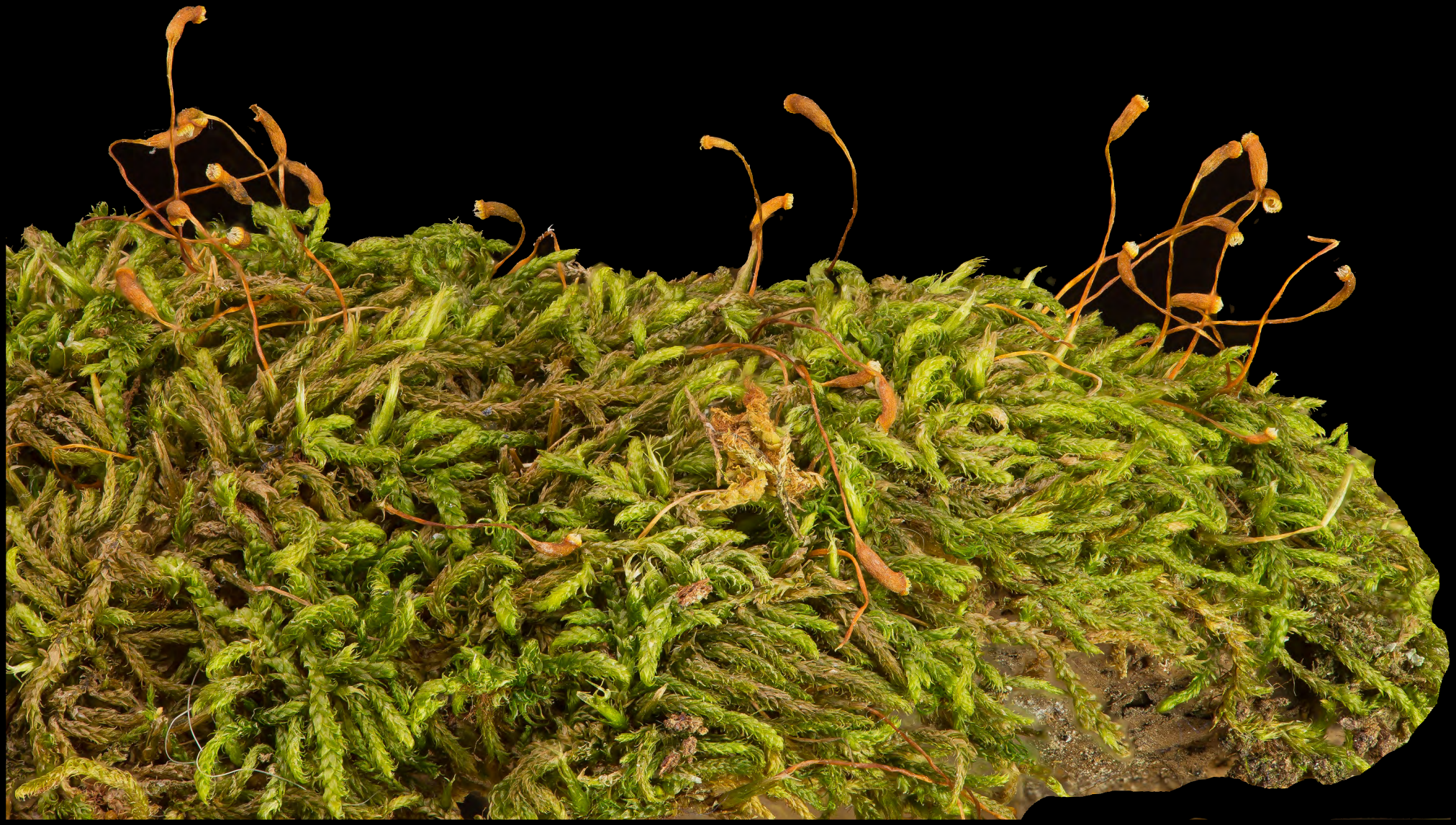
Loose thatch

Must know

Microscope needed

Long-tipped leaves, turned in one direction. The teeth on the leaves, and the recurved lower edges cannot be seen without a microscope.

Curving leaves with their tips turned downwards, pinnate branches, small size. The largest branches here are about 2 mm wide.



With old (and bent up) capsules) in a thick mat on dead wood.

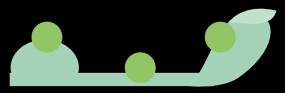
A typical growth form, thin mats and traceries on a log that has lost its bark but is still fairly hard; *imponens* looks much the same but is bigger.

ISOPTERYGIOPSIS MUELLERIANA Small, shiny, strongly flattened moss; shoots featherlike; leaves with slender tips; outer cells of stem strongly inflated.

An inconspicuous moss of moist, often limy soil or ledges with limy seepage, recognized in the field by the flattened, feather-like, shiny shoots and in the lab by the combination of short costa, undifferentiated alar cells, needle tips to leaves, and inflated stem cortex. May have elongate, segmented brood bodies in leaf axils.

flattened featherlike shoots; leaves with long slender tips; outer cells of stem inflated

Calcareous seepage



Calcareous rocks or soil

Flat fronds

Low flat mat

F

Identifiable in field

U

Uncommon

Shoots only a few millimeters wide, in loose mats or mixed with other mosses, looking stiff and featherlike; here with *Plagiochila asplenioides* and *Lepraria*.

ISOTHECIUM MYOSUROIDES Light yellow-green frondose shoots, making fringes on boulders; leaves costate, sharp toothed, with slender tips, not falcate secund.

An uncommon moss of the north Atlantic coast, typically found as fringes on boulders in cold conifer or mixed woods. Recognized in the field by the yellow-green color, frondose shoots, and curved branches. Under the scope, the sharp teeth, single costa, and thick-walled alar cells are diagnostic. *Hypnum cupressiforme* and *imponens* are often abundant in the same woods and can look quite similar. The costas in *Isothecium* will separate them, but can be hard in the field. We look for the frondose growth and curved branches, but still can be fooled.

Rocks and ledges in boreal forest

Arching fronds

Shingles

F

Identifiable in field

U

Uncommon

Yellow-green fronds with curving branches, making loose mats on the sides of rocks.

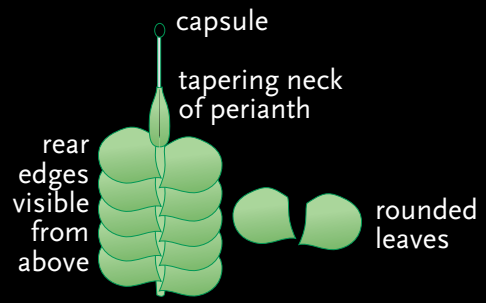
Branches often pendant, resembling a *Hypnum* but the leaves not falcate secund or neatly braided.

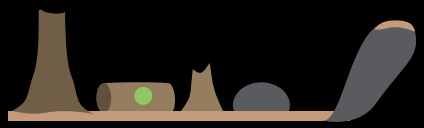
Pendant, swirling branches. Hypnums dangle but don't swirl.

JUNGERMANNIA & JAMESONIELLA Shingled, rounded-oblong leaves, arching outward, with the back edges visible, inconspicuous underleaves.

This specimen was not checked microscopically and we are not sure what it is. The red color suggests *Jamesoniella* but some of the unopened perianths look like *Jungermannia*.

Two small liverworts with unlobed leaves and inconspicuous underleaves. *Jamesoniella* seems the more common, and is frequent or common on rotting logs in moist or swampy woods. It has a tapering perianth with a tiny fringe at the tip. *Jungermannia*, apparently scarcer, has a truncate perianth and no fringes. *Odontoschisma denudata,* also round-leaved and found on moist logs, has concave rather than arched leaves and a ball of gemmae at the tip of the stem.



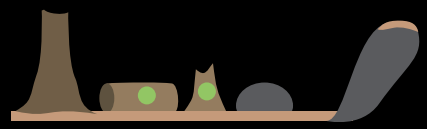


Forest interior

Low flat mat

LEPIDOZIA REPTANS Tiny plants with deeply lobed leaves whose lobes curl like fingers.

Tiny liverwort, fairly common but inconspicuous, making thin mats or growing among other bryophytes on rotting wood. Immediately recognized, once you see them at all, by the deeply three-lobed or four-lobed leaves whose lobes curl in like fingers.



Forest interior

Low flat mat

Lepidozia shoots, less than 1 mm wide, crawling over plants of *Leucobryum*.

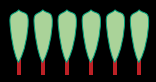
LEPTOBRYUM PYRIFORME Small moss of disturbed soil, with needle-tipped leaves, stems that are black at the base, and nodding capsules with long slender necks.

A small moss with long, needle-tipped leaves. Common as a greenhouse weed, widespread but not particularly common outdoors on moist disturbed soil. The nodding capsules, which are abruptly contracted to a long neck when mature, are distinctive. Sterile plants resemble a *Dicranella* or *Ditrichum* but have longer cells and stems that are black at the base.

nodding capsules abruptly narrowed to long slender necks

needle-tipped leaves with long cells and clasping bases

Open disturbed soil



Groves

Small cushions

F

Identifiable in field

U

Uncommon

Light yellow-green, leaves with long-excurrent costas, in loose clumps or groves; stem black at base.

Clasping leaf bases abruptly narrowed to the long tips.

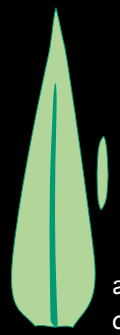
Young capsules with a long-beaked calyptra.

Leaves long and wispy; mature capsules abruptly narrowed to a long skinny neck.

LEPTODICTYUM RIPARIUM A long-leaved aquatic moss that floats or trails in ponds and streams; leaves costate, with long middle cells and undifferentiated alar cells.

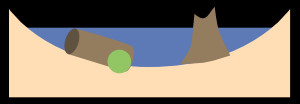
long, inclined capsules

A common moss of slow waters and marshy ponds. Close to *Amblystegium* but with longer skinnier leaves with longer cells; and to *Drepanocladus* but with small alar cells and shorter cells. Always check it with the microscope; aquatic mosses are super variable.



long costate leaves with long cells

alar cells not differentiated



Submerged wood

Trailing in water

C

Common in right habitat

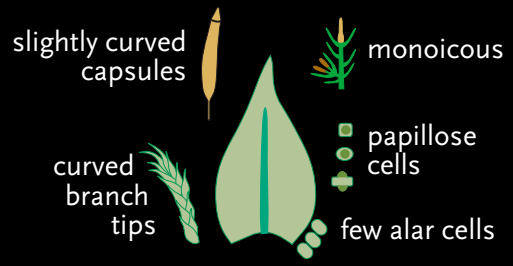
Microscope needed

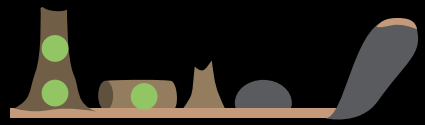
Slender, well-spaced leaves with long tips; straight-leaved forms of *Drepanocladus* are similar.

Often in tangles.

LESKEA POLYCARPA GROUP Stringy plants, not regularly pinnate, with small, oval, short-pointed leaves with short cells with single papillae.

Common mosses of tree bark and tree bases and (at least in swamps) of fallen logs that remain off the ground, generally yellow-green and opaque when dry, irregularly branched, somewhat stringy, and making thin or thick mats. Probably the commonest of the small string bark mosses (*Amblystegium*, *Leskeella*, *Lindbergia*, *Pterigynandrum*...) of which there are a daunting number. Best characters are the short-pointed leaves, irregular branching, and cells with single papillae. We have three *Leskeas*, all closely related and variable, and treat them as a group here.





Trees, logs

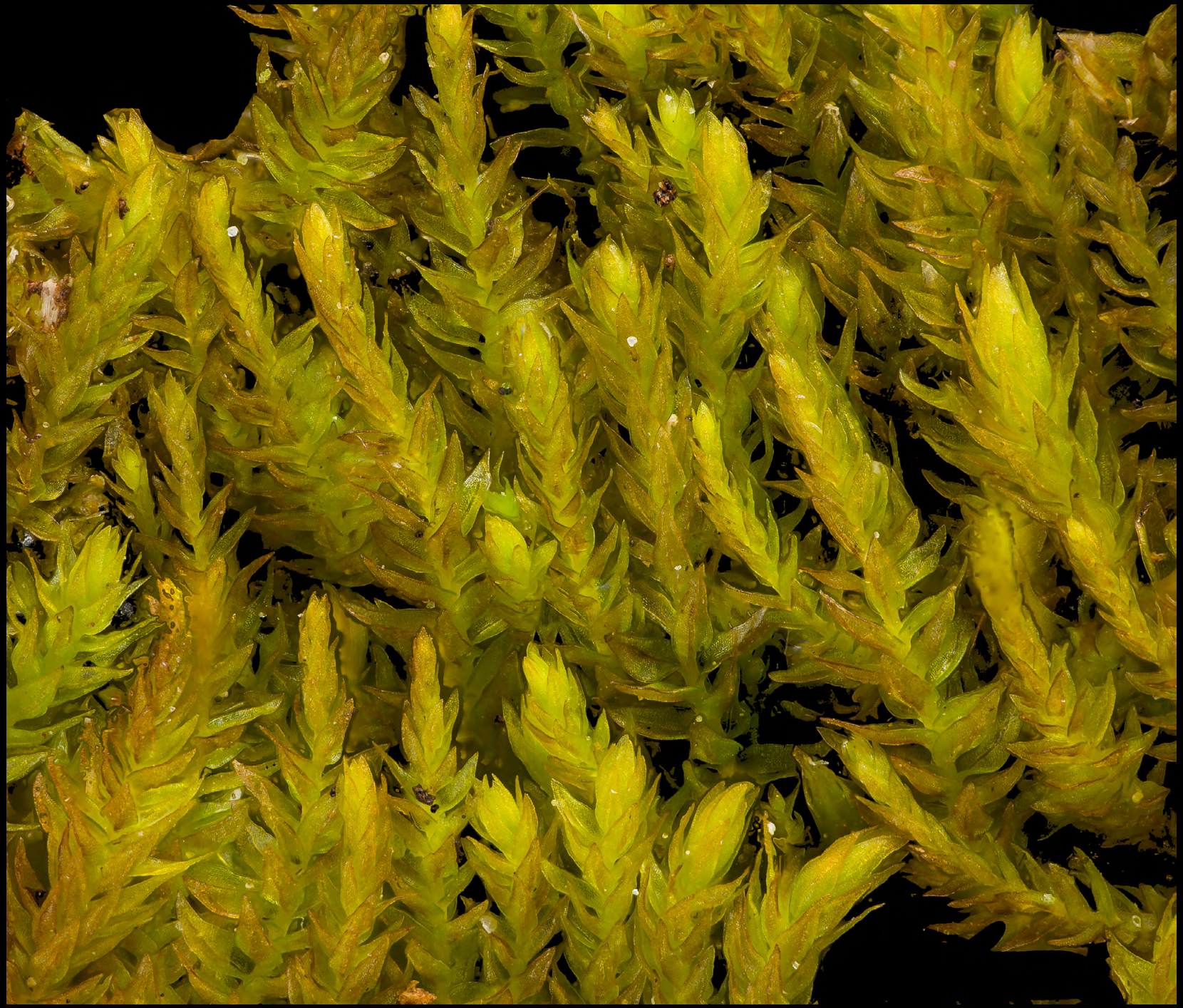
Loose thatch

Low flat mat

Must know

Microscope needed

Dry yellowed plants in late winter; small round stringy branches, small costate papillose leaves.



Commonly yellow-brown and stringy looking when dry, irregularly branched or loosely pinnate but never regularly pinnate.

Commonly yellow-brown and stringy looking when dry, irregularly branched or loosely pinnate but never regularly pinnate.

Wet leaves widely spreading; capsules erect, elongate, with white peristomes.

Rounded triangular, costate leaves, widely spreading when wet, dull and opaque when dry; *Amblystegium varium* is similar but is not papillose and has inclined rather than erect capsules.

Light yellow-green, sometimes orange in spring; dry branches slightly clubbed.

LESKEELLA NERVOSA A small moss making thin dark mats on tree bark; narrow-elliptical leaves with small oval cells and the costa filling the tip; often with clusters of brood branches at the branch tip.

A small, scruffy, dark-green moss of tree bark, with costate leaves with the costas filling the tips, short oval cells, and clusters of brood branches near the branch tips. *Platygyrium*, our commonest tree-bark creeper, also has brood branches and slender leaf tips. It is a shinier moss, with longer cells and no costa.

Trees

Low flat mat

F

Identifiable in field

C

Common in right habitat

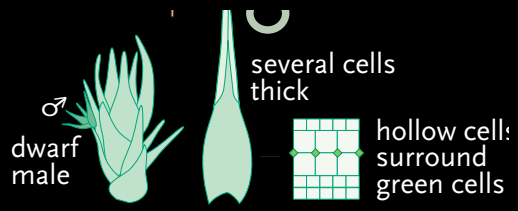
Small shoots in tangled mats; leaves with slender tips; brood branches clustered at tips of stems.

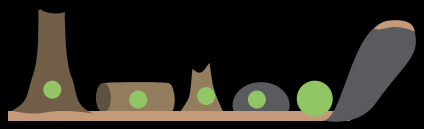
Long-tipped leaves, erect or somewhat spreading; long costas extending into the tips; sparse mats; red setae in spring.

Stringy when dry; brood branches (circled) spread.

LEUCOBRYUM GLAUCUM Erect plants with thick, inrolled, green or white-green leaves, forming dense cushions.

Common on the forest floor in both deciduous and boreal woods forming mounds or sometimes confluent patches. Also on tree roots, well-decayed logs, and hummocks in swamps. The leaves are essentially all costa: several cells thick, with small green cells surrounded by larger water-holding ones. Often associated with *Dicranums*, particularly *scoparium* and *flagellare*.





Tree bases, rocks, and soil near the forest floor.

Large cushions

M

Must know

Large mounds and cushions in a wooded swamp, early spring.

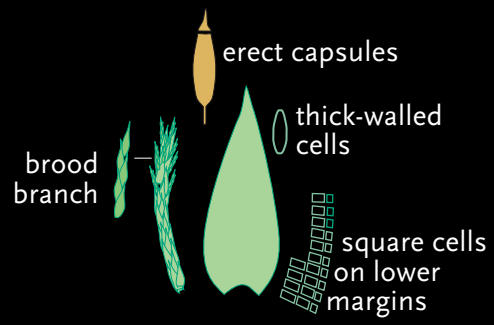
Erect, white-green leaves, dense cushions on the forest floor.

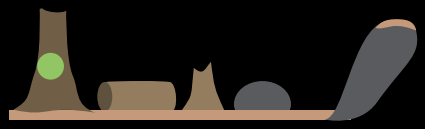
Thick, inrolled leaves, appearing spongy.

With the liverwort *Lepidozia reptans*. I don't know what the frizzy thing is.

LEUCODON ANDREWSIANUS Elongate, round, medium-sized branches curving outward from tree trunks and making shingles or fringes; long-pointed, secund, ecostate leaves with thick-walled cells and many small square cells along the lower margins; small brood branches at the tips of the main branches.

Common on trees, especially maples, in older forests, with upcurved, coat-hook branches that form shaggy fringes. Often with *Neckera pennata*. Usually identifiable from the growth habit and ecostate leaves. Confirmatory features are the thick-walled, somewhat diamond-shaped upper cells and numerous square cells on the margins. *Leucodon brachypus* is a similar species without the brood branches.





C

Common in right habitat

Stringy, round, shiny branches curving outwards from bark.

Curved, cylindrical branches with hooked tips.

Concave, long-pointed leaves without costas.

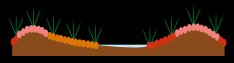
LIMPRICHTIA REVOLVENS Large golden or brown moss with costate, falcate secund leaves; alar and outer stem cells inflated.

A northern moss of rich fens, rich gold or deep red gold in the sun, with the leaves curled almost into rings. Alar and stem cortical cells inflated. *Hamatocaulis*, which can be reddish too, has no inflated cells.

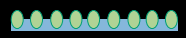
long curved leaf tips

inflated alar and outer stem cells

stems with a central strand



Calcareous fen



Loose wet mat

U

Uncommon

Microscope needed

Red-gold, glossy, strongly curved leaves.

Loosely-pinnate to irregular.

LINDBERGIA BRACHYPTERA Small moss of tree bark; leaves costate, with white needle tips, springing open suddenly when moistened; cells papillose.

A small stringy sprongmoss of tree bark, recognized by the white needle tips of the leaves and the way the leaves spring open and spread widely when wet. Leaves costate, with short papillose cells; small oblong cells along the lower margins. *Campylium hispidulum,* another small moss of bark and logs, also has widely spreading leaves with needle tips. Its cells are smooth, and the tips of the dry leaves aren't white.

Trees

Low flat mat

U

Uncommon

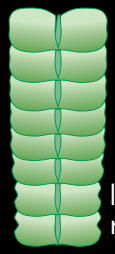
Microscope needed

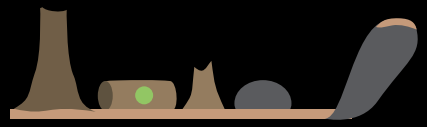
Dry leaves erect, with white needle tips.

Wet leaves widely spreading.

LOPHOCOLEA HETEROPHYLLA Small, pale, flat liverwort with oblong leaves, some notched and some with squared off tips.

Small common liverwort making pale traceries on logs that have recently lost their bark. The best field mark is the varying leaf shape, with the lower leaves (and sometimes all the leaves on sterile shoots) notched, and the upper ones squared off or rounded. Almost always associated with *Nowellia curvifolia,* another small liverwort which has deeply lobed leaves with needle points. The mats of *Lophocolea* and *Nowellia* are often colonized by larger mosses, in this case *Hypnum pallescens,* and shaded out.





MEESIA Rare mosses of limy fens and seepage, with curved, long-necked capsules, leaves often in rows, and square cells.

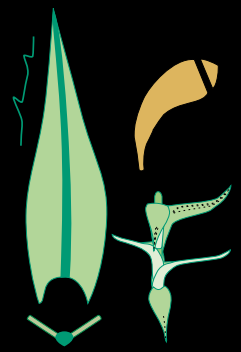
Three rare species with curved long-necked capsules, two shown here. Vegetatively they have leaves with strong costas and rectangular cells, but not much else in common. All are associated with calcareous soil: *triquetra* is a fen plant, *uliginosa* a plant of limy seepage.

triquetra

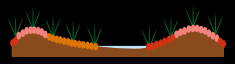
uliginosa

MEESIA TRIQUETRA Medium-sized species with the leaves in three spiraling rows, arching out when wet. Looks like an auger with three flutes.

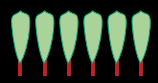
An uncommon species found in small amounts in limy fens, easily recognized by the wide-spreading oval leaves in three rows. Capsules curved, with long necks.



leaves in three rows, curled when dry, arching out when wet



Calcareous fen



Groves

F

Identifiable in field

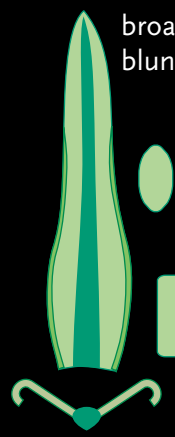
R

Rare

Oval leaves tapered to sharp points, in three spiraling rows; shoots sparsely branched, in open clumps.

MEESIA ULIGINOSA Tiny species with blunt straplike leaves with recurved edges and wide costas; curved capsules tapering into a long neck.

A small rare northern species of limy ledges and seepage, recognized by the straplike leaves with broad costas, blunt tips, and smooth rectangular cells. Nothing else looks like it.



Calcareous seepage

Scattered

F

Identifiable in field

R

Rare

Uliginosa is dioicous; in the center, a male plant with antheridia surrounded by perigonial leaves; left and right, females plant with a young sporophytes.

Uliginosa, which is small, growing in a turf with even smaller plants of *Kurzia, Cephalozia,* and a slender-leaved moss we can't identify; from a calcareous seep on the shore of Lake Superior.

MIELICHHOFERIA ELONGATA Rare species of mineral-rich seepage; plants small and budlike, leaves bright blue-green or white-green, under 0.8 mm long.

A tiny, very rare moss of mineral-rich seepage with a widely scattered distribution. Plants bright green, densely packed together into groves or turfs, only a few millimeters high, with leaves less than a millimeter long. The best marks are the dense clumps, the bright blue-green color, the tiny leaves, and, when present, the erect capsules, and the single peristome. *Pohlia* is vegetatively similar but considerably bigger and never blue-green.

Turf

Dense mat

F

Identifiable in field

R

Rare

Small, bright white-green, budlike plants.

Small plants in a dense turf, bright white-green, slightly glossy. They resemble *Pohlia cruda*, but are smaller and brighter.

Habitat for *Mielichhoferia elongata*: seepy basalt cliffs, Cape Onion, Newfoundland.

D

hornum Locally dominant

C

marginatum Common in right habitat

Common mosses with oval bordered leaves (unbordered in *stellare*) with paired teeth, found in woods, along streams, on banks, and on ledges. The teeth are conspicuous in *hornum, spinulosum,* and *thomsonii* and small and hard to see in *marginatum* and *stellare*.

The species separate fairly well by habitat: *hornum* is on wet banks, *spinulosum* in cold moist woods, *stellare* in fertile woods, and *marginatum* and *thomsonii* on limy ledges or in limy seepage.

Plagiomnium, equally common or commoner, has single teeth and produces arching flattened sterile shoots. *Mnium* sometimes arches, but doesn't flatten.

Mnium ambiguum, not photographed, is close to *thomsonii* and *marginatum*; we haven't been able to distinguish it reliably.

C

spinulosum Common in right habitat

C

stellare Common in right habitat

C

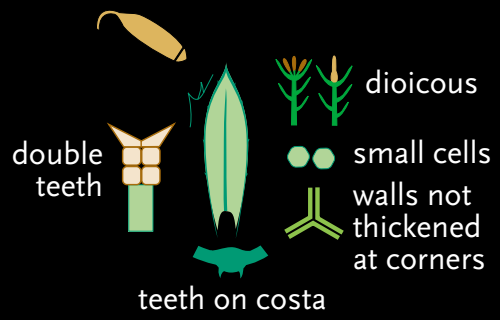
thomsonii Common in right habitat

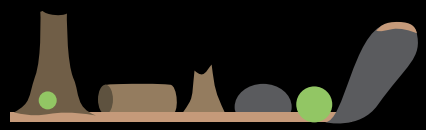
M

Must know

MNIUM HORNUM Long-elliptical leaves with borders, double teeth, and a costa that is toothed on the lower side and stops just below the tip.

Common on wet forest floors, especially on sandy soils near streams, in both deciduous and coniferous woods; occasional on tree bases. Our commonest true *Mnium*, usually easily distinguished by the long leaves, double teeth, and toothed costa.

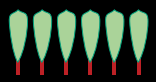




Shaded soil, tree bases

Stream banks

Erect fronds



Groves

D

Locally dominant

M

Must know

Long leaves, long sharp double teeth, erect growth. Unlike *Plagiomnium* (single teeth), sterile *Mniums* don't form arching, flattened shoots.

Plants often large, forming mounds or cushions on moist soil.

On the bank of a woodland stream, with *Atrichum undulatum*. Both trap sediment and build levees (bryolevitation) and stabilize stream banks.

MNIUM MARGINATUM Small plants with small blunt double teeth, needle tips on the leaves, and cells that are thickened in the corners.

A small, pretty *Mnium* typically found in the recesses of moist ledges, often with limy seepage. In the field it is recognized by the very small teeth and the needle tips of the leaves. Confirm by the blunt double teeth, prolonged leaf tips, and thickened corners where cell walls meet. *Mnium thomsonii*, with sharp teeth, is common in the same habitat.

small blunt teeth, needle tips to leaves, thickened corners where cells meet

Calcareous seepage

Calcareous rocks or soil

Erect fronds

Thin doormat

C

Common in right habitat

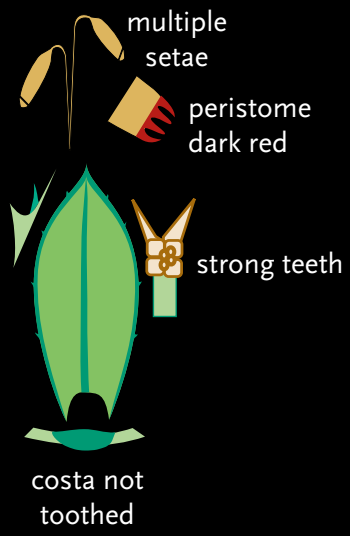
Microscope needed

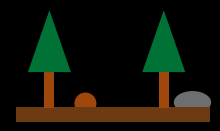
Typical habitat, on soil in a recess of a moist calcareous cliff.

Long leaf tips, tiny blunt teeth.

MNIUM SPINULOSUM Teeth strong, peristome red, costa not toothed (sometimes with a few tiny teeth), often with multiple setae.

A handsome species of the floors of moist conifer forests, liking fertile soils. It is marked by the oval leaves with conspicuous teeth, smooth costas, and multiple setae. The capsules appear in late summer, after our other Mniums, and are light tan with dark red peristome teeth. This and *M. hornum* are the two medium-sized Mniums regularly seen on forest floors. *Hornum* has longer and narrower leaves, a toothed costa that ends below the tip, single setae, and yellow peristomes.





Conifer forests

Erect fronds

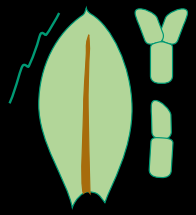
Must know

Dark-green, strongly toothed leaves; often several setae per shoot.

The long sharp teeth and oval or oboval leaves are distinctive. The costa is either smooth or with a few tiny teeth.

MNIUM STELLARE Small pale species with unbordered leaves with very small teeth.

A small, pale *Mnium* that grows in clumps on moist, fertile, often limy soil. We find it on ledges and on soil around tree bases. The plants are pale or silvery, the teeth tiny, and the leaves unbordered.



pale silvery unbordered leaves with very small teeth

Soil by tree bases

Calcareous rocks or soil

Small cushions

F

Identifiable in field

U

Uncommon

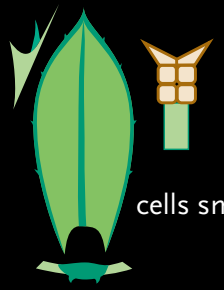
Pale unbordered leaves, small teeth.

Loose or tight clumps.

Young and old plants, in a turf on a seepy bank in a fertile oak wood; there is not enough contrast for the stacking software to resolve the young leaves.

MNIUM THOMSONII Small calciphile with strongly toothed costa and margins; cells smaller than *marginatum*.

A small species, common in crevices in limy rocks, often with seepage and *Mnium marginatum*. Both *thomsonii* and *marginatum* are somewhat silvery with red stems. *Thomsonii* is separated by its sharper teeth, toothed costa, and smaller cells. A third species, variously called *ambiguum* or *lycopodioides*, is said to have the teeth of *thomsonii* and the cells of *marginatum*. We have not been able to distinguish it clearly from *thomsonii*.



Calcareous seepage

Calcareous rocks or soil

Erect fronds

C

Common in right habitat

Microscope needed

Small, pale, toothy, red-stemmed; zoom in to see the teeth on the costa.

MNIUM THOMSONII

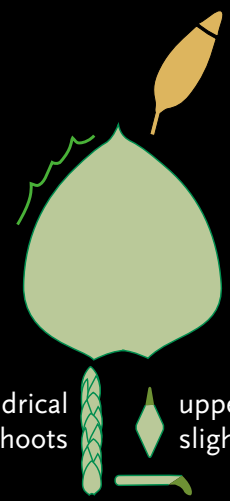
julacea

Two small mosses, locally common in the crevices of limy rocks and on banks with limy species, with concave, broadly oval leaves. In *julacea* the leaves are tightly overlapped and make cylindrical shoots, the teeth are tiny, and the cell tips protrude a bit. In *sibirica* the leaves of mature shoots are spaced out, the teeth are spiny, and the cells strongly papillose. *Sibirica* is a creeper, *julacea* a matter.

sibirica

MYURELLA JULACEA Leaves tightly overlapping, the shoots pencil-like; leaves with low teeth and short points; cells protruding slightly at their tips.

A small wormlike moss that grows from creeping stems and can form dense mats. Leaves broad and spoon shaped, with tiny teeth, prorate cells, and no costas. Common in rock crevices and on soil bank, usually with limy seepage. *Anomobryum* and *Plagiobryum* also have cylindrical shoots and can grow with *Myurella*. They are acrocarps with costas and smooth cells that do not form dense mats.



Recesses with limy seepage,

Scattered

Thin doormat

F Identifiable in field

C Common in right habitat

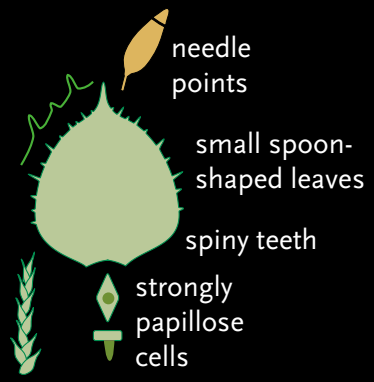
Cylindrical wormlike shoots from a mat of creeping stems. Acrocarps like *Bryum argenteum* that produce shoots like these have costate leaves and lack the mat of basal stems.

In a mat, in limy seepage and over calcitic marble, with *Myurella sibirica* (all mixed in), *Mnium marginatum*, *Fissidens subbasilaris*, *Gymnostomum aeruginosum*, and something else, maybe *Brachythecium*.

In a dense mat, with *Tortella tortuosa,* a small *Scapania,* and the lichen *Solarina saccata*, from marble ledges in the splash zone of the Indian River, Adirondacks.

MYURELLA SIBIRICA Leaves loosely overlapping, with spiny teeth, sharp-pointed tips, and strongly papillose cells.

The more widely distributed and less boreal of our two Myurellas, with separated leaves with needle points, spiny teeth, and high papillae. Always on limy rocks or in limy seepage. Forms mats where it is cool and sheltered, grows as scattered plants among other mosses where it isn't.



Calcareous rocks or soil

Calcareous seepage

Scattered

Low flat mat

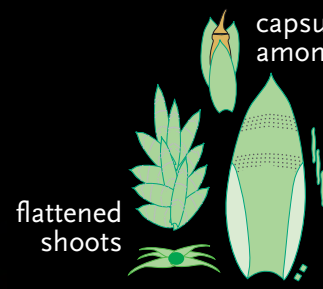
Must know

Concave leaves, well-spaced at maturity, with strongly papillose cells, spiny teeth and small curly tips.

In loose clumps from a mat of creeping stems.

NECKERA PENNATA Flattened branches with ripply leaves without costas, making shaggy fringes on trees.

Common on the trunks of deciduous trees, particularly sugar maple and ash, in old, primary forests. Also found on hornbeams, birches, and others. When well developed can make large shaggy patches from the ground to high in the crown. Absent from secondary (post-agricultural) woods and most commercial forests. Easily recognized by the large size, flattened branches, and wavy (undulating) leaves without midribs. Quite pretty, but hard to photograph.



Old trees in old woods

Shingles

M

Must know

Grows in horizontal rows, something like gutters, that intercept stem flow.

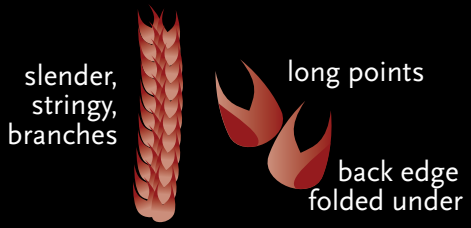
Closely overlapping, wavy, shiny leaves.

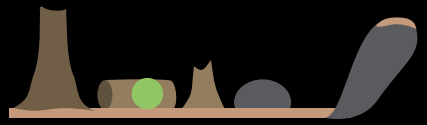
On a red maple, Nova Scotia.

Pinnate,flattened shoots, ripply leaves. Hard to photography clearly.

NOWELLIA CURVIFOLIA Tiny, worm-like liverwort with lobed leaves with long points.

Abundant on recently fallen logs that have just lost their bark, making extensive red or green mats. Often with *Dicranum flagellare* or *Dicranum montanum*, and, less conspicuously, the small pale-green liverwort *Lophocolea heterophylla*. The crescent-shaped leaves with long needle points are unique among our small liverworts.



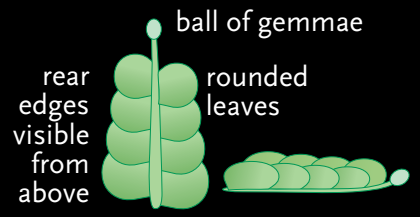


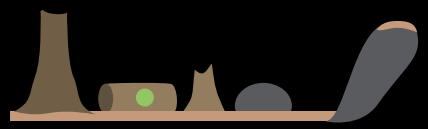
With *Dicranum montanum* on a wet log, probably hemlock.

Stringy or wormlike growth, with separated leaves that make the stems appear beaded.

ODONTOSCHISMA DENUDATUM Small creeping liverwort with round, upwardly concave leaves and balls of gemmae at the tips of the shoots.

A small, reasonably common liverwort of wet logs, usually in swamps or swampy woods. The leaves are rounded, upwardly concave, and shingled with the rear edges visible from above. There are usually balls of gemmae (propagules) at the tips of sterile shoots. Liverworts like gemmae. *Jamesoniella autumnalis* and *Jungermannia leiantha* have similarly shaped leaves, but theirs are usually curved downwards rather than concave upwards, and they lack the gemmae. Liverworts often grow in multispecies mats; here, besides the *Odontoschisma* there is *Kurzia sylvatica* with threadlike leaves, and a *Cephalozia* with notched leaves.



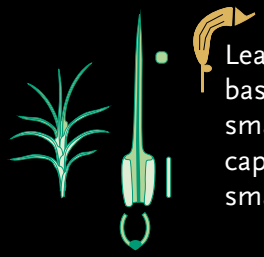


Forest interior

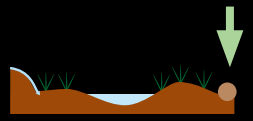
Low flat mat

ONCOPHORUS WAHLENBERGII Leaves with sheathing bases and long, slender curly tips, capsules with a swelling at base.

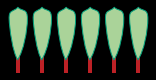
Frequent on well-decayed logs in wet woods or swamps, or wet wood in lakes and ponds. The plants are light colored and grow in loose mats; the tips spread in all directions, and curl up when dry. *Dicranella heteromalla,* which also has long tips, is darker, grows in denser mats, and is less curly.



Leaves with clasping bases and long tips, small round cells, capsules with a small basal swelling.



Logs in wetlands



Groves

Must know

Loose groves, long curly tips.

Leaves are narrow all the way to the clasping base.

On a wet log in a calcareous swamp, with *Trichocolea tomentella*.

ORTHOTRICHUM Small dark plants in clumps on bark or rocks; leaves lanceolate, papillose, often reflexed edges, straight when dry; capsules exserted or surrounded by leaves; calyptras smooth or hairy; stomates exposed or partly covered by adjacent cells.

anomalum

obtusifolium

ohioense

A common genus of rocks and tree bark: plants dark, in tufts or small clumps, with lanceolate leaves, weakly papillose cells, and erect, cylindrical capsules on short setae. Similar to *Ulota* and often grows with it. There are no characters that will separate all Ulotas from all Orthotrichums, but, as a rule, Ulotas are curlier when dry and tend to have hairier calyptras and capsules that are exserted farther and taper more gradually to the setae.

The species of *Orthotrichum* are separated best by the characters of the capsules and calyptras. The leaves differ a bit between species but, with the exception of the tiny, blunt *Orthotrichum obtusifolium*, not enough for good identifications.

sordidum

stellatum

strangulatum

Small cushions

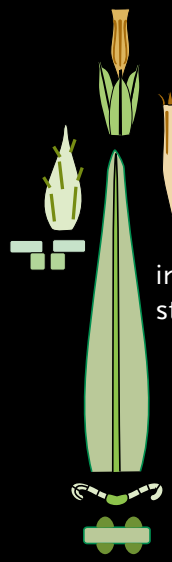
Tufts

Must know

Microscope needed

ORTHOTRICHUM ANOMALUM A characteristic species of limy rocks with exserted capsules that when dry have eight long ribs and 8 partial ones; stomates covered; calyptras sparsely hairy.

A fairly common species of limy rocks. The habitat suggests the ID. The covered stomates and the alteration of strong and weak ribs on the capsule confirms it. *Ulota hutchinsiae*, similar to and sometimes growing with *anomalum*, has hairier calyptras and capsules with reflexed peristome teeth, eight long ribs, and exposed stomates.



Calcareous rocks or soil

Tufts

C

Common in right habitat

Microscope needed

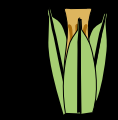
Straight, erect, leaves, capsules well exserted (unusual in *Orthotrichum*), few hairs on calyptra. Compare *Ulota hutchinsiae*.

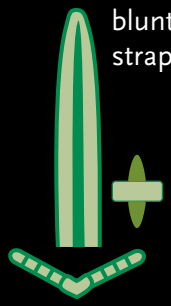
On a marble boulder.

ORTHOTRICHUM OBTUSIFOLIUM A small distinctive species with blunt straplike leaves, tall single papillae, reddish-brown brood bodies.

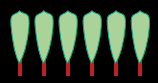
On maple bark, with the lichen *Phaeophyscia rubropulchra*. Photos here and below from a faded specimen.

Fairly common on the trunks of deciduous trees, particularly maples and apples. Recognized in the field by its small size, olive-green to yellow-green color, and blunt leaf tips. Recognized microscopically by the flat leaf margins and single high papillae, which may be forked at the tip. Almost always sterile.





Trees



Groves

Tufts

F

Identifiable in field

C

Common in right habitat

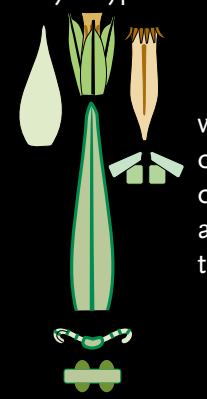
Blunt oval or straplike leaves with brown gemmae on the surfaces; tall papillae visible on the margins.

ORTHOTRICHUM OBTUSIFOLIUM

Plants only a few millimeters high, scattered or in small groups, looking a bit like artichokes when dry.

ORTHOTRICHUM OHIOENSE A tree-bark species with capsules surrounded by leaves; calyptras smooth or slightly hairy; capsules with slender ribs, covered stomates and 16 peristome teeth.

A small tree-bark species resembling *stellatum*, but with capsules that are less strongly contracted under the mouth, and have 16 peristome teeth and thinner ribs. The calyptras are often sparsely hairy.



Trees

Tufts

U

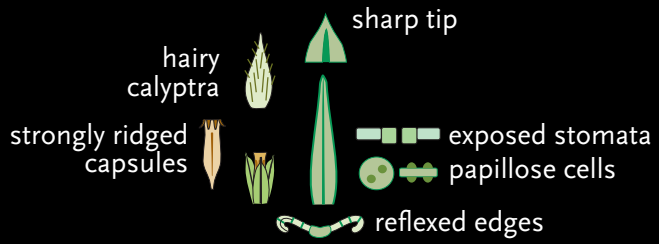
Uncommon

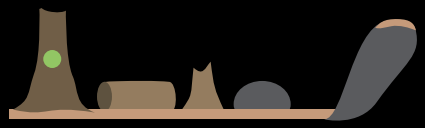
Microscope needed

Capsules with fairly weak, indistinct ribs, not strongly contracted under the mouth.

ORTHOTRICHUM SORDIDUM Our largest *Orthotrichum*; lanceolate, papillose leaves with reflexed edges, straight when dry, capsules with hairy calyptras, strong ribs, and exposed stomata.

Common in small tufts or cushions on tree bark, recognized as an *Orthotrichum* by the straight leaves that do not curl when dry, and as this species by the hairy calyptras, strongly ribbed capsules, and exposed stomata of the capsule. A scarcer species, with more exserted capsules with almost no ribs, is likely *Orthotrichum speciosum*.





Forest interior

Small cushions Tufts

C

Common in right habitat

Microscope needed

Sharp-tipped leaves, hairy calyptras, capsules partly surrounded by leaves, slightly contracted under the mouth, with strong clear ribs.

Wet and dry: loose clumps, hairy calyptras, partly exserted capsules with strong ribs when dry.

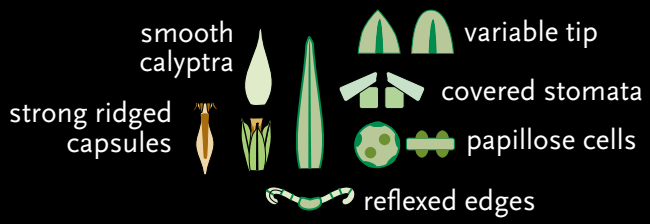
On maple bark, with *Frullania eboracensis* and lichens.

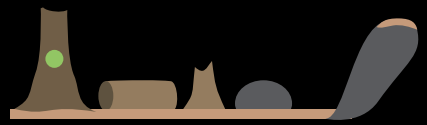
The capsules are ribbed and only slightly contracted below the mouth when dry.

With *Ulota crispa*, one of our commonest epiphytes, *Frullania eboracensis, Leskea, Phaeophyscia ciliata*, etc. The partly concealed capsules are found in all our tree-bark *Orthotrichums* except *speciosum* and differ from the long-exserted ones of *Ulota*.

ORTHOTRICHUM STELLATUM Lanceolate, papillose leaves with reflexed edges, straight when dry, capsules with smooth calyptras, strong ribs, a strong constriction below the mouth, and covered (immersed) stomata.

A very common *Orthotrichum*, smaller than *sordidum* and differing in the smooth calyptras, covered stomates, and strongly ribbed capsules with a strong constriction below the mouth when dry.





Forest interior

Small cushions Large cushion

Tufts

C

Common in right habitat

Microscope needed

Smooth calyptras; dry capsules strongly contracted under the mouth; the ribs almost touch.

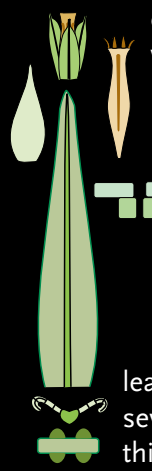
Smooth prophylactiform calyptras; the *pettite mousse sauce et priapique* of French botanists.

Smooth calyptras, strongly ribbed capsules.

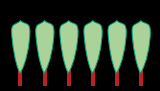
New hairless calyptras and old capsules. The capsules show the strong ribs (zoom in!) but, because they are moist, not the constricted neck. The lichen may be *Phaeophyscia pusilloides*.

ORTHOTRICHUM STRANGULATUM Small dark and rare, on dry limy rocks; calyptras sparsely hairy; capsules partially emerging from the leaves, strongly constricted under the mouth when dry, with covered stomates and 16 peristome teeth.

A rare species of dry limy rocks, often dark green or brown, with sparsely hairy calyptras and emergent capsules that are strongly contracted under the mouth and have 8 ribs. Under the microscope, it has covered stomates, thickened leaf margins, and 16 peristome teeth. *Anomalum*, the common species on limy rocks, has exserted capsules with 8 long ribs and 8 short ones. *Stellatum*, common on trees, has capsules that are even more strongly contracted.



Calcareous rocks


Groves

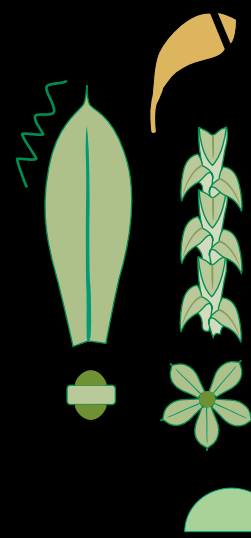
Tufts

R
Rare

Microscope needed

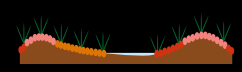
PALUDELLA SQUARROSA Small distinctive moss with hooked leaves in five rows.

A unique moss of rich fens, recognized immediately by five rows of short hooked leaves. Typically long and skinny, with the shoot only a few millimeters wide. May grow in small cushions or scattered among other mosses. Locally common, though often hidden, in the subarctic; rare with us.



elliptical leaves, hooked downward, in five rows

Small cushions or scattered among other mosses



Calcareous fen

F Identifiable in field

C Common in right habitat

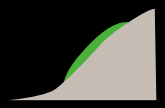
Slender sparsely-branched shoots, short hooked leaves, abundant rhizoids.

With *Campylium stellatum*.

PALUSTRIELLA FALCATA An uncommon northern species of limy seepage, found on cliffs and in fens; falcate-secund, costate leaves; slender paraphyllia on stems; alar and outer stem cells not inflated.

Rare and northern: medium sized, often yellow-brown, with slender, long-tipped, costate leaves and slender paraphyllia. Basal cells thickened; stem cortex not inflated; alar cells not inflated. Probably indistinguishable in the field from *Sanionia, Hamatocaulis, Drepanocladus,* and others. The paraphyllia are the key.

Calcareous seepage



Mats on cliffs

Mossicle

R

Rare

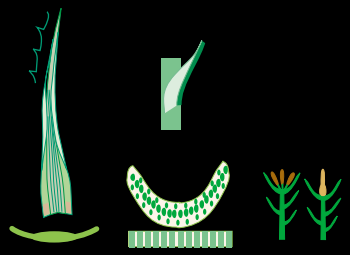
Microscope needed

Sickle-leaves with costas and pleats; irregularly branched; often golden brown. *Hamatocaulis* and *Limprichtia* look the same in the field.

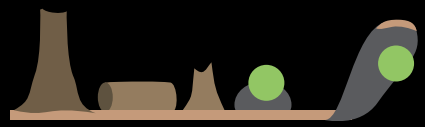
PALUSTRIELLA FALCATA

PARALEUCOBRYUM LONGIFOLIUM Silvery green, leaves long, slender and curved to one side, the tips filled with the costa.

Common on boulders and ledges in northern woods, either forming large patches or as scattered plants among other species. Resembling the large *Dicranums* with a broad costa with alternating stripes of green and white (empty) cells. Zoom in to see.



slender leaves filled with a flattened costa that is mostly empty cells



Shaded boulders and ledges

Loose thatch

Must know

Microscope needed

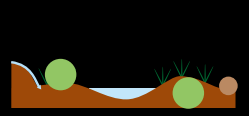
Large, curly, and silvery.

PHILONOTIS Silvery plants, forming dense clumps or mats in seeps; leaves with long slender tips, papillose by projecting cell ends; stems often with rhizoids.

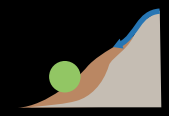
fontana

marchica

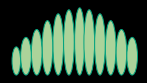
Common mosses of wetlands and seeps. Slender red stems, silvery leaves with small sharp teeth, rectangular cells whose ends project at both upper and lower ends (*fontana*) or only at the upper (*marchica*). The plants are pale green, sparsely branched, and often grow in large loose mats or cushions. *Pohlia wahlenbergii* is superficially similar but has much larger cells that are not rectangular or papillose.



Open wetland



Dirty wet ledges



Loose mounds

Must know

Microscope needed

PHILONOTIS FONTANA White-green or silvery plants in seeps with papillose leaves with long toothed tips. Cells papillose at the lower ends in the bottom or middle of leaf.

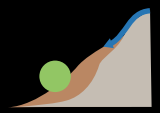
The common species of wetlands and seeps. Slender red stems, silvery leaves with long tips and small sharp teeth, cells whose ends project at the lower end in the lower parts of the leaf and sometimes at both ends above. The plants are pale green, sparsely branched, and often grow in large loose mats or cushions. Watch for *Pohlia wahlenbergii,* superficially similar with larger cells that are not papillose. *Philonotis marchica* is almost identical but has cells that are papillose at the upper. To me, this is a cheap way to make a species.

short, round capsules

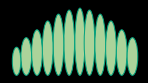
small triangular leaves with needle tips

cells project at lower end or both ends

Open wetland



Dirty wet ledges



Loose mounds

Must know

Microscope needed

Red stems, slender sharp tips; leaves sometimes falcate secund.

Red stems, sparsely branched, small papillose leaves with needle tips and sharp teeth.

A sprawling shade form, in calcareous seepage at the base of a cliff.

Erect form, in a pool in a gravel pit.

PHILONOTIS MARCHICA Superficially identical with the commoner *Philonotis fontana* but the leaf cells only protruding on the upper surface.

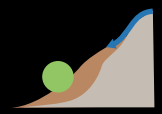
Small stringy mosses of wetlands and seeps, often in large mounds or mats. Light-green or yellow-green; stems red; leaves silvery, with small sharp teeth, the costas often projecting as needle tips; cells rectangular, their ends projecting above and below. *Philonotis fontana* is our common species. *Philonotis marchica* differs, unimpressively, in the amount of toothing and has cells that project at the upper ends only. *Pohlia wahlenbergii*, very similar in the field, has much larger cells whose ends don't project.

short, round capsules

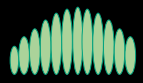
small triangular leaves with needle tips

cells project at upper ends only

Open wetland



Dirty wet ledges



Loose mounds

U

Uncommon

Microscope needed

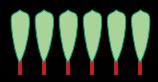
Left, male plant with antheridia surrounded by perigonial leaves; right, capsules.

PHYSCOMITRIUM PYRIFORME Small, nonpersistent plants producing translucent, spoon-shaped leaves and top-shaped capsules on long setae.

A common short life-cycle moss of open disturbed soil, especially common in areas that have been plowed or disturbed. Leaves translucent, pointed, with large thin-walled cells and a weak border. Capsules top-shaped, raised above the leaves on a short seta. Several related genera (*Funaria, Physcomitrella, Aphanorrhegma*) have similar leaves and are best recognized by the capsules. Individual plants are said to be ephemeral, but in fact can persist through a season or over the winter. And colonies can reappear for several years in the same place, presumably by spores.

pale leaves, large cells, exserted capsules

Open soil



Groves

M

Must know

Usually on open, recently disturbed, mineral soil.

Translucent, oboval leaves with sharp points; with *Weissia controversa*.

Top-shaped capsules, beaked calyptras, long setae.

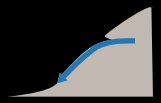
PLAGIOBRYUM ZIERI Small northern moss, very rare with us; cylindrical shoots, pale silvery leaves with large cells, lower stems often reddish, capsules elongate.

An arctic-subarctic species with a scattered distribution, found on calcareous rocks. Very rare in the northern forest. Looks, except for the elongate capsules, like a larger version of *Bryum argenteum,* from which it is separated by the larger size, shorter tips on the leaves, large thin-walled cells, red lower stems, and alpine habitat. *Anomobryum julaceum*, which can grow with *Plagiobryum,* has tapering branches, longer and narrower leaf cells, and no red on the lower stems.

long-necked, horizontal capsules

pale white-green leaves with large, thin-walled cells

cylindrical shoots



Seepy ledge

Tufts

F

Identifiable in field

R

Rare

Leaves concave, tightly overlapping, green below, silvery above; lower stems red. Plant at left is a collection from 1999.

PLAGIOMNIUM Bordered, oval to oblong leaves with single teeth to the base; sterile shoots often flattened, with the leaves in two rows.

M

ciliare Must know

M

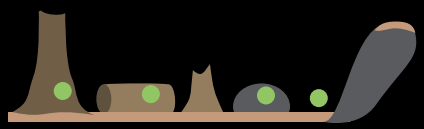
cuspidatum Must know

ellipticum

C

Common in right habitat

Some of our commonest forest mosses, found on wet soil, logs, rocks and tree bases. Leaves oval, strongly bordered, with single shoots that may be large or small. Sterile shoots often flattened; setae single or multiple; capsules nodding, without clear necks. Compare *Rhizomnium,* rounder leaves without teeth, and *Mnium*, double teeth, sterile shoots never flattened.



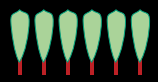
Forest interior

U

medium Uncommon

U

rostratum Uncommon



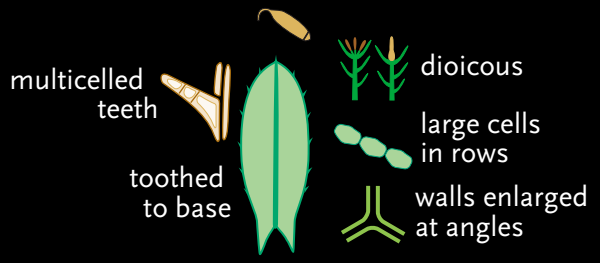
Groves

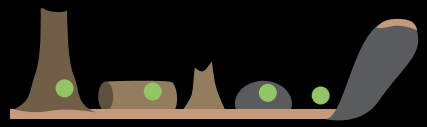
M

Must know

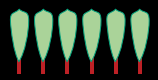
PLAGIOMNIUM CILIARE Bordered, oval to oblong, long decurrent leaves with multi-celled single teeth to the base, large cells in diagonal rows, and single setae.

The second-commonest forest *Plagiomnium*, after *cuspidatum*, common on wet soil, logs, rocks and tree bases. The long teeth, extending to the base of the leaf, are usually sufficient to identify it. Plants with one-celled or two-celled teeth, or with multiple setae may be either of two related species, *Plagiomnium ellipticum* or *Plagiomnium rostratum*.





Rock, soil, wood in moist forests



Groves

Arching fronds

Must know

Microscope needed

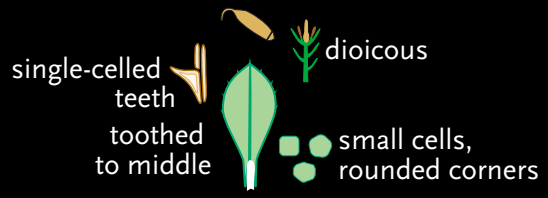
Bordered oval decurrent leaves with long teeth; shoots somewhat flattened.

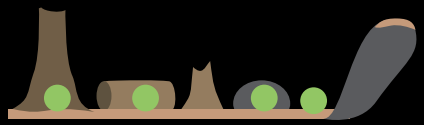
Long teeth extending to the base of the leaf, large cells in rows.

Male plants with antheridia at upper left; flattened sterile shoots center; with *Thuidium delicatulum*.

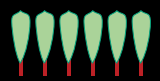
PLAGIOMNIUM CUSPIDATUM Bordered, short-oval leaves with short teeth extending to the middle and small cells with rounded corners.

The commonest forest *Plagiomnium* in our area, forming large patches on tree bases, rocks, and logs in wet woods and also occurring mixed with other mosses, particularly *Brachythecium* and *Thuidium*. Generally recognized by the small, single teeth that don't extend below the middle. The rare *Plagiomnium drummondii* (longer teeth, bigger cells with sharper corners, can have multiple setae) is similar; we don't know whether it can be distinguished in the field.





Moist wood, rock, and soil near the forest floor



Groves

Arching fronds

Identifiable in field

Must know

Microscope needed

Erect fertile plants; setae appear in late fall or winter; capsules appear in early spring and mature in summer.

Erect fertile plants with new capsules, 29 March, 2020.

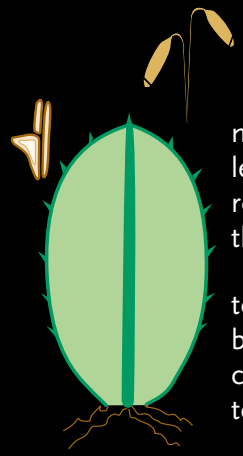
Left, an erect shoot, which may be fertile. Above, a mat of flattened, arching, sterile shoots.

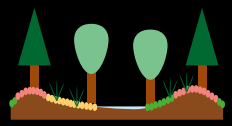
Flattened sterile shoots; *cuspidatum* has short-oval leaves and the teeth only in the upper half.

Bordered leaves with small single teeth, not extending below middle.

PLAGIOMNIUM ELLIPTICUM Rounded nondecurrent leaves with blunt one-celled or two-celled teeth; marginal cells much smaller than cells near costa.

Our third common species, found in hummocks in swamps, on stream banks, and in seeps. It is quite variable and so hard to confirm. Related to *ciliare* but with shorter teeth and non-decurrent leaves that tend to be rounded at the tips. A useful microscopic feature is the large leaf cells near the costa that contrast with smaller marginal cells. Dioicous and often sterile.





Swamp

Arching fronds

C

Common in right habitat

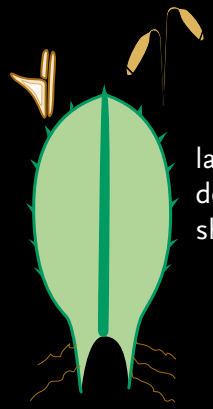
Microscope needed

Teeth variable, often low or absent; often mixed with other mosses; with *Eurynchium hians.*

Often tangled and sterile; here with *Campylium chrysophyllum* and *Eurynchium hians*, on shaded fertile soil with seepage.

PLAGIOMNIUM MEDIUM A large species, the shoot to 10 cm long; leaves decurrent, with sharp, single-celled teeth; may have several setae per stem.

Our largest *Plagiomnium*, uncommon but locally abundant in woods, on limy ledges, and old quarries. Seems to like moist sheltered limy sites. Recognized by the large size, multiple setae, decurrent base, and sharp 1-celled teeth.



Calcareous rocks or soil

Groves

Arching fronds

F

Identifiable in field

U

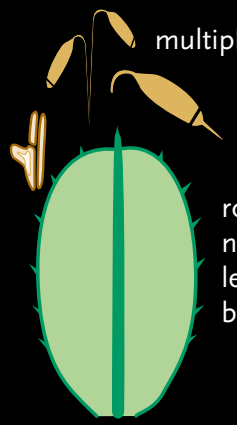
Uncommon

Large decurrent oval leaves with sharp teeth; fertile shoots erect, sterile shoots arching and flattened.

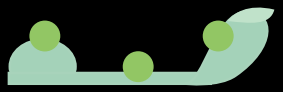
Multiple setae.

PLAGIOMNIUM ROSTRATUM Small, often with creeping stems that attach to the soil; leaves blunt or notched at the tip, not decurrent, with small cells that are rounded at the corners.

An uncommon species of soil and ledges where there is limy seepage. Medium-sized, grows flat, and roots along the stems. It resembles *ellipticum* in its non-decurrent leaves with rounded or squared-off tips and short teeth. The best characters are the small, nonpitted cells that are strongly thickened at the corners and, when fertile, the multiple setae and long beaks on the capsules.



Calcareous seepage



Calcareous rocks or soil

Low flat mat

U

Uncommon

Microscope needed

Blunt, nondecurrent leaves, erect fertile shoots, flattened sterile ones; with a sprig of *Campylium*.

Teeth low or obscure; shoots often root at their tips.

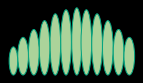
Often with multiple setae.

PLAGIOPUS OEDERIANA Arching leaves with long, sharply toothed tips; red, three-sided stem, round capsules.

A medium-sized moss that makes loose tufts or cushions on rocks with limy seepage. Related to *Bartramia,* and, like it, has long, doubly toothed leaf tips and round capsules. Resembles *Amphidium* in the field, grows in similar places, and has similar elongate papillae that cross the cell walls. The leaf tips of *Amphidium* are shorter and not toothed.

Arching leaves with recurved edges, toothed tips, and cells with low, elongate papillae

Calcareous seepage



Loose mounds

U

Uncommon

Microscope needed

Linear-lanceolate leaves, long tips, rounded capsules.

Loose cushions, long tips, rounded capsules.

PLAGIOTHECIUM Shiny plants; leaves decurrent at base, untoothed, with long cells, short double costas, and undifferentiated alar cells; outer stem cells inflated.

C

cavifolium Common in right habitat

C

denticulatum Common in right habitat

The *Plagiotheciums* are mat-forming mosses of wet rocks, soil, and logs, with slender cells, long capsules, and untoothed decurrent leaves with short double costas. They have long capsules, often have flattened shoots, and are very common in moist shady places. If a forest moss is ecostate, shiny, and strongly flattened, there is a good chance that it is a *Plagiothecium.* But there is also a good chance that it is *Taxiphyllum, Pseudotaxiphyllum, Isopterygiopsis*, or even *Herzogiella,* and so a microscope check is always wise.

The species of *Plagiothecium* are identified by leaf shape, the width of the decurrencies, and the shape of the decurrent cells. *Cavifolium* often is identifiable from its deeply concave leaves and *latebricola* from the gemmae on the leaf tips. The others need the microscope.

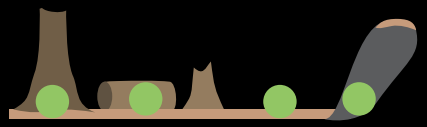
Overall, *cavifolium* is both common and conspicuous, often forming large mats on wet shaded ledges. *Laetum* and *denticulatum* are also common but less dominant, though they often make nice shiny fringes where water drips off rocks. *Latebricola* is tiny, uncommon, and inconspicuous. It is around, but has to be looked for hard.

C

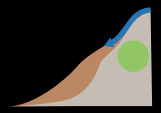
laetum Common in right habitat

U

latebricola Uncommon

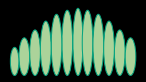


Moist shaded places in forests



Dirty wet ledges

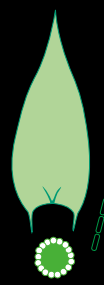
Loose thatch



Loose mounds

PLAGIOTHECIUM CAVIFOLIUM Shiny plants with symmetrical, concave, leaves with narrow decurrencies.

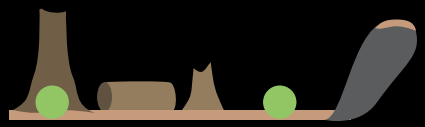
Our largest plagiothecium, common in wet woods and sometimes covering whole faces on shaded moist cliffs. Distinguished by the concave, symmetrical leaves, slender decurrencies without inflated cells, and some (often many) shoots which are terete rather than flattened.



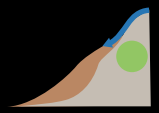
concave, oval-lanceolate, symmetrical leaves with short points

slender decurrencies at base

long capsules, may have brood bodies

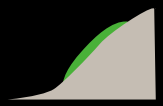


Moist shaded places in forests



Dirty wet ledges

Loose thatch



Mats on cliffs

D

Locally dominant

Microscope needed

Symmetrical leaves with short tips; decurrencies slender; shoots (in this form, flattened).

New terete (nonflattened) shoots from last year's matted old ones.

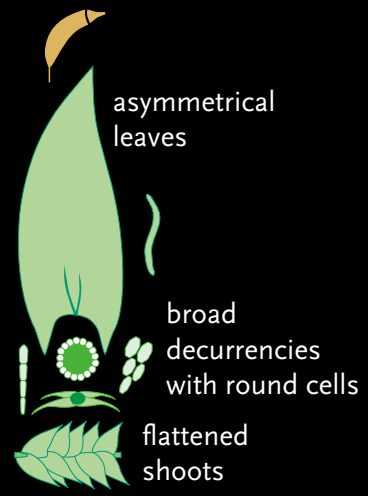
Terete shoots on new growth.

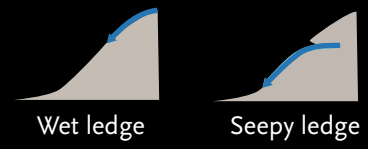
The form with partially flattened shoots, in a recess on a moist cliff.

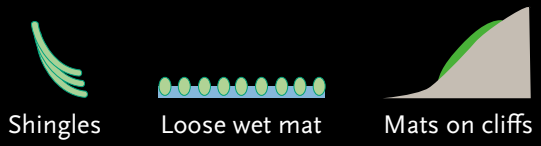
Catching surface flow over the edge of a rock shelf, forming a cushion with a drip edge; with a cushion of *Brachythecium laetum* on the right.

PLAGIOTHECIUM DENTICULATUM Shiny plants with flattened shoots, asymmetrical leaves, and broad decurrencies with rounded cells.

A common species on wet rocks, making fringes on dripping ledges and in small channels. Similar to *laetum* but often larger. Mature shoots shiny, strongly flattened, with broad decurrencies with round cells. Quite similar to *laetum* in the field; distinguished microscopically by the larger cells and broader decurrencies.







C

Common in right habitat

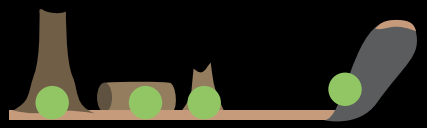
Microscope needed

Flattened shoots; curved, asymmetrical leaves; broad decurrencies.

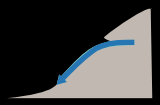
Shoots often arch downwards, forming fringes or drip edges.

PLAGIOTHECIUM LAETUM Small shiny plants with asymmetrical leaves with narrow decurrencies.

Our third common *Plagiothecium*, smaller than *cavifolium* and *denticulatum* and occurring on tree bases and logs as well as wet cliffs. The flattened shoots and asymmetrical leaves are like *denticulatum*, from which it differs in the smaller cells and narrower decurrencies.



Tree bases, logs, rocks in forests



Seepy ledge

Low flat mat

Shingles

C

Common in right habitat

Microscope needed

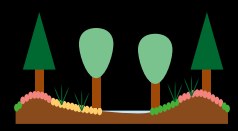
Small shiny plants with asymmetrical leaves with narrow decurrencies. Very close to *denticulatum* the field.

Often forming fringes or drip edges.

Decurrencies slender, hard to see with a lens.

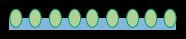
PLAGIOTHECIUM LATEBRICOLA Small shiny plants with symmetrical (but often folded) leaves that bear brood bodies or rhizoids near the tips.

A small species of rotting wood near streams and in swamps. Leaves with enlarged cells near the tips which produce elongate gemmae or rhizoids. Can be recognized in the field if the gemmae are present; our other species produce brood branches or gemmae at the bases of the leaves but not at the leaf tips.



Swamp

Loose thatch



Loose wet mat

U

Uncommon

Microscope needed

Leaves wide spreading; rhizoids or brood bodies at leaf tips. This specimen has only a few brood bodies left, but many modified tips where the brood bodies were.

PLATYDICTYA Small stringy mosses with leaves 0.5 millimeters long or less, barely visible with a hand lens. Costas short or absent, cells short, alar cells small and square.

confervoides

jungermannioides

Very small, sparsely branched pleurocarps forming thin mats or traceries on bark and calcareous rocks. Leaves under 0.5 mm with short cells and short double costas or none. Other small stringy pleurocarps (*Amblystegium, Leskeella, Pterigynandrum*...) have larger leaves and may be costate. The genus can be presumptively identified in the field by the small size; confirmation and species identification requires the scope.

U

Uncommon

Microscope needed

PLATYDICTYA CONFERVOIDES Tiny, sparsely branched plant making thin mats on limy rocks; leaves untoothed; alar cells in several rows; rhizoids smooth.

A tiny species of dry limy rocks, with wide branch angles, untoothed leaves, and slightly differentiated alar cells. *Platydictya jungermannioides* is similar but has papillose rhizoids, tiny teeth, and almost no differentiated alar cells.

Calcareous rocks or soil

Low flat mat

U

Uncommon

Microscope needed

Slender stringy branches, only about 0.2 mm wide; largest leaves about 0.6 mm, smallest ones about 0.2 mm.

A small plant collected on maple bark by Johanna Laggis on maple bark in Hardwick, Vermont. The habitat suggests *Platydictya subtilis,* but the cells look like *P. confervoides.* One more mystery mini-moss!

PLATYDICTYA JUNGERMANNIOIDES A tiny species, the leaves under 0.5 mm long, hard to see even with a lens; rhizoids papillose, leaves with minute teeth, alar cells almost undifferentiated.

A northern species of limy rocks and soil, uncommon here. The best marks are the narrow branch angles, almost undifferentiated alar cells, minute teeth, and papillose rhizoids.

leaves with minute teeth and almost undifferentiated alar cells

Calcareous rocks or soil

Low flat mat

U

Uncommon

Microscope needed

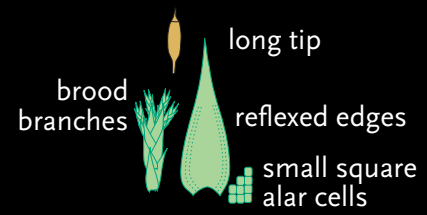
In thin mats on a dry marble boulder. *Platydictya* is the small dark plant; the larger light-green one is *Homomallium adnatum*.

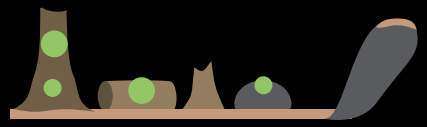
Slender, stringy, with tiny leaves; indistinguishable from *confervoides* in the field; large bright plants are *Homomallium adnatum*.

PLATYGYRIUM REPENS Small, brown-green creeper with slender, long-tipped leaves; often has erect branches with clusters of tiny branches at their tips.

shoots with broad tips have brood branches within the leaves

A small moss, very common on tree bark and also found on logs and occasionally rocks. Easily recognized when the erect stems with clustered brood branches are present. Lacking them it is a dark, red-green or brown-green moss with slender, long-tipped leaves that creeps or forms thin mats, and has square alar cells and reflexed edges. *Pylaisia* is vegetatively similar and often grows with *Platygyrium* but tends to form horizontal fringes of curved branches on bark.





Tree bark, rocks, logs

Low flat mat

M Must know

Microscope needed

Leaves slender, spreading, sharp-tipped; older shoots brown-green; main branches creeping; with *Punctelia rudecta*.

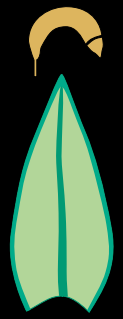
Dark, red-brown, traceries and mats on a recently fallen log.

Creeping branches, close to the surface, with slender, long-pointed leaves; often brownish or olive. Very common, though not always conspicuous.

Erect branches with normal leaves, bearing clusters of tiny branches with tiny leaves at their tips.

PLATYLOMELLA LESCURII A small stringy moss found on rocks in streams with costate, bordered leaves with short cells.

Small moss with oval, costate, bordered leaves, found on rocks in streams, usually submerged at high water. The border is diagnostic but hard to see in the field. Resembles *Hygroamblystegium tenax,* which lacks borders.



oval leaves with short cells, a strong costa, and a border of longer cells

Rocks in streams

Low flat mat

U

Uncommon

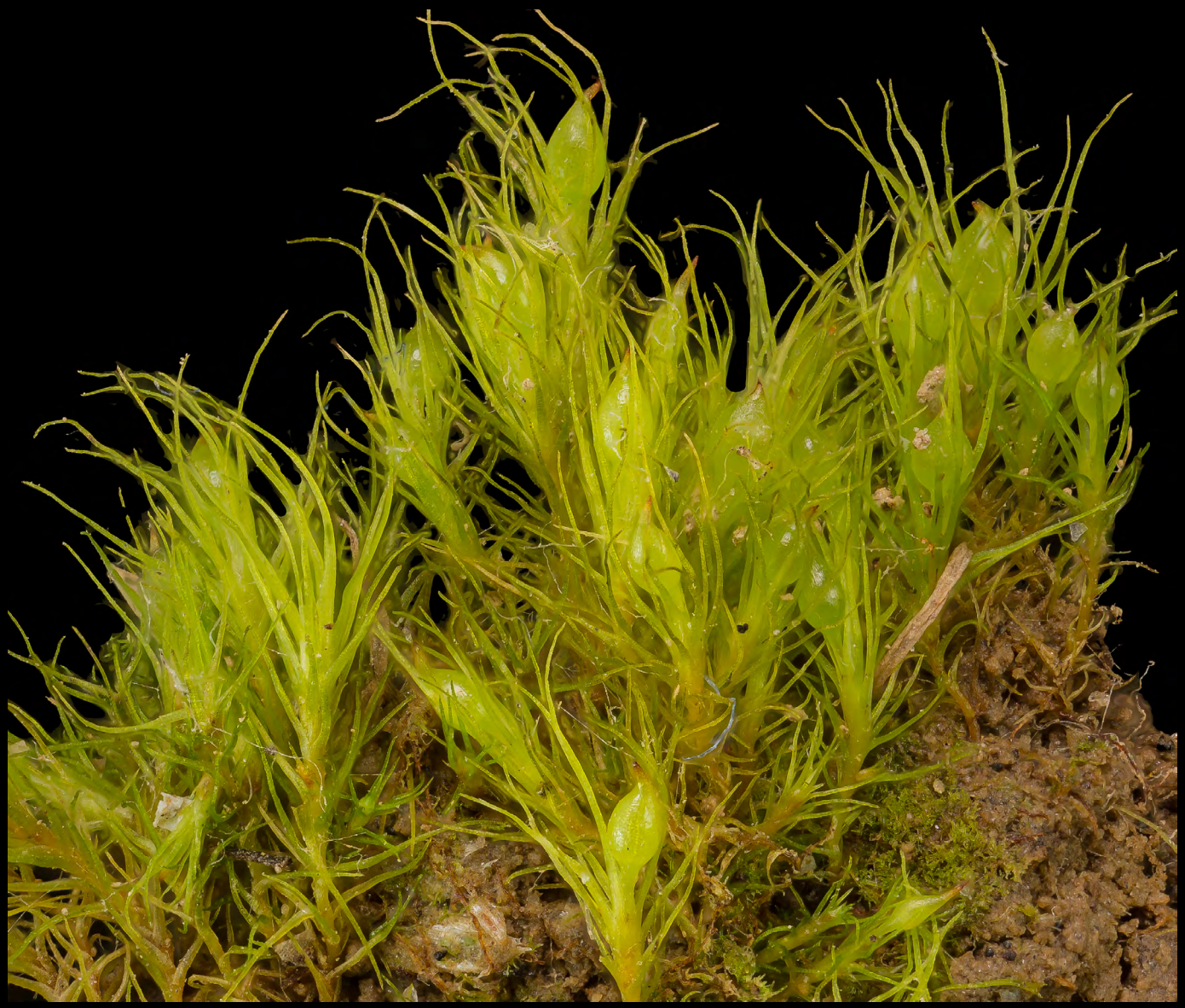
Microscope needed

Stringy, forming thin mats on rocks; leaves with a strong costa and a border which is hard to see with a lens.

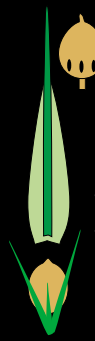
The border is distinct but faint. Transmitted light is best. I can see it clearly at 30 ×, with difficulty, sometimes, at 10x.

A boulder from a woodland stream. The larger plants are *Hygrohypnum eugyrium*,the small dark ones *Platylomella*.

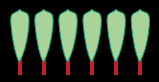
PLEURIDIUM SUBULATUM Short life-cycle moss of open soil; slender leaves with needle tips, surrounding round capsules with stomates at the base.



Small moss of cultivated ground and moist open soil, recognized by the needle-tipped leaves, hooded calyptra, and oval capsules with stomates at base. Uncommon but can be locally abundant. Sterile plants much like *Dicranella* or *Ditrichum*.



Open soil

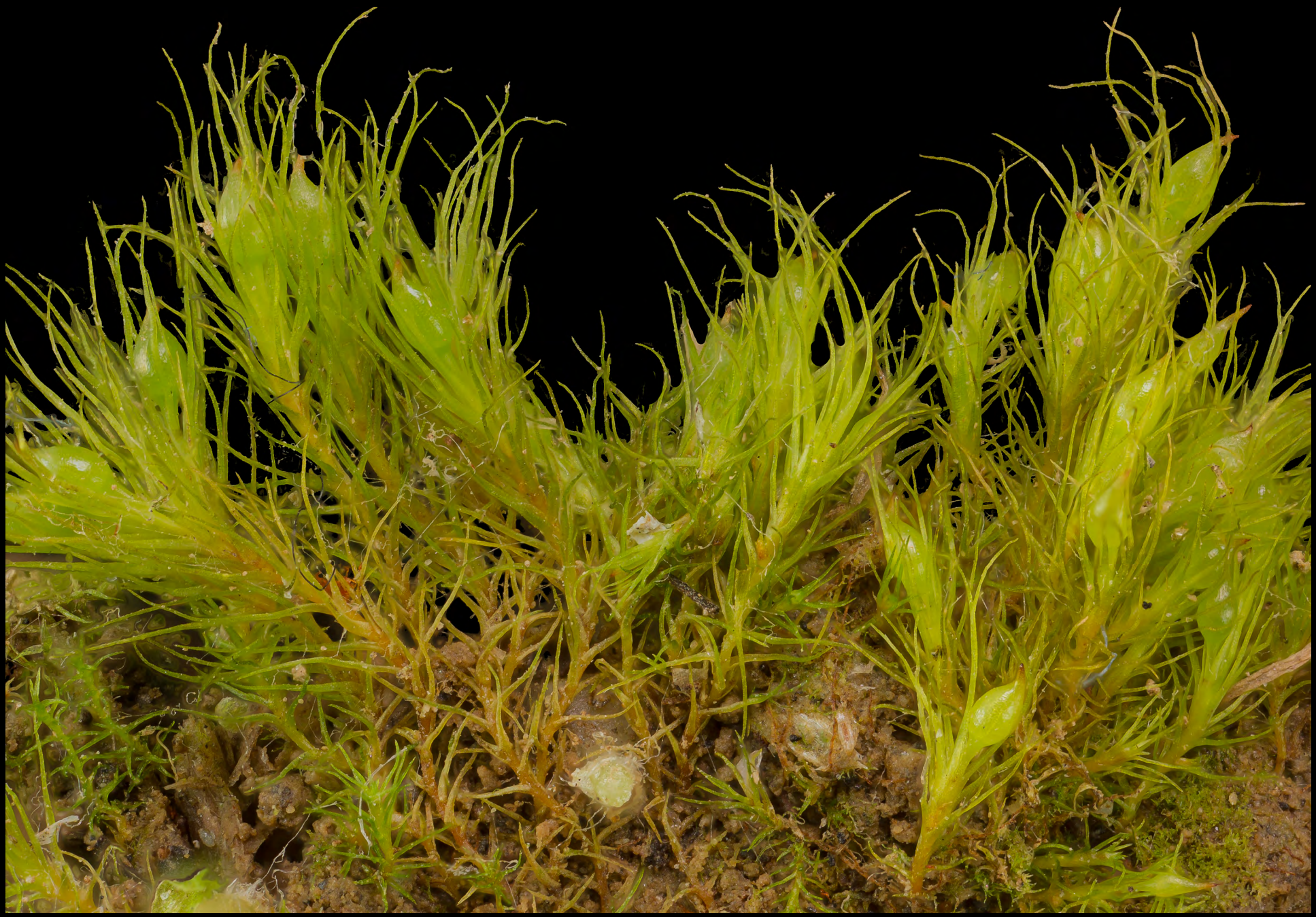


Groves

U Uncommon

F Identifiable in field

Microscope needed



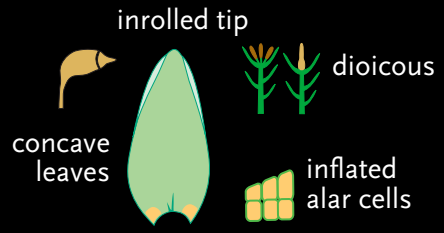
Tall stems, slender leaves with excurrent costas, oval capsules surrounded by the leaves.

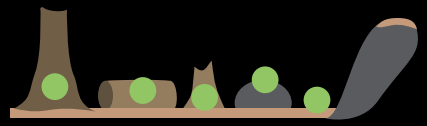
Often in mats or loose clumps; leaves look silky.

Physcomitrium pyriforme (broad leaves, exserted capsules) growing with *Pleuridium subulatum* (narrow leaves surrounding capsules).

PLEUROZIUM SCHREBERI Large, erect or arching, loosely pinnate, with red stems and shiny, blunt, concave leaves.

A large, abundant moss of forest floors, especially in dry boreal forests where it can be dominant over large areas. Easily recognized: erect, loosely pinnate growth, red stems, shining, concave leaves. Often with the other boreal coveralls: *Ptilium*, *Hypnum imponens, Bazzania,* and *Polytrichum*.





Any exposed substrate near the forest floor

Loose thatch

M

Must know

Red stems, erect growth, pinnate branching, large concave stem leaves, no paraphyllia.

New growth light green in spring, turning yellow-green in fall and winter; shoots arch, new shoots arise from backs of old.

Light gold-green leaves, erect, loosely pinnate growth, red stems; with *Polytrichum*.

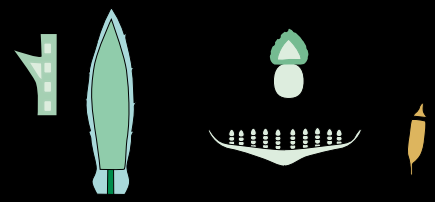
Old browned plants, with *Polytrichum juniperium*.

POGONATUM Stiff-leaved plants resembling *Polytrichum* but with the uppermost cells of the lamellae papillose.

pensilvanicum

Blue-green plants with stiff, opaque leaves which, like *Polytrichum* have photosynthetic lamellae (plates) covering the upper surface. In *Polytrichum* the cells at the top edge of the lamellae are smooth; in *Pogonatum* (and *Polytrichastrum*) they are papillose.

Our Pogonatums divide into two groups: a species with tiny leaves that grows from a protonemal mat, and two larger species that look like small blue-green *Polytrichums.* The larger species overlap in field characters and must be separated with the microscope. The small one, *pensilvanicum,* is common on soil banks and immediately recognizable from the protonemal mat. The larger species, *dentatum* and *urnigerum*, are common on exposed soil and rock at high elevations and also occur sporadically on gravel and disturbed soils at lower elevations. They may be recognized, as a group, by the broader leaves, blue color, and, often, the leaves arranged like those of a palm tree above a short stem.

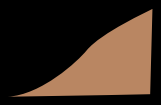


Broadly lanceolate leaves with sharp teeth, terminal cells of lamellae papillose

dentatum

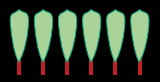
urnigerum

Alpine zone



Soil bank

Open soil



Groves

Scattered

Protonemal mat

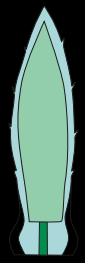
C

Common in right habitat

POGONATUM DENTATUM Stiff-leaved plants resembling *Polytrichum* but with the leaves shorter and broader, often blue-green; uppermost cells of the lamellae papillose; capsules cylindrical; terminal cells of the lamellae flat-topped; leaf sheaths without borders.

Small blue-green species with short, relatively broad leaves, looking like small palms. Terminal cells of the lamellae flat-topped, sheaths not bordered. Common on open soil in the alpine zone, occasional at lower elevations, especially on the northern coast. Very similar to *Pogonatum urnigerum* and often grows with it.

cylindrical capsules

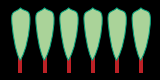


broad blue-green leaves, on short stems; sheaths without a border

terminal cells of lamellae flat-topped and papillose

Alpine zone

Open soil



Groves

Scattered

C

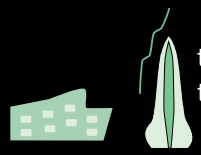
Common in right habitat

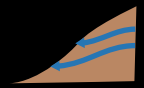
Microscope needed

Short stems, relatively broad leaves, sharp teeth.

POGONATUM PENSILVANICUM Small plants with cylindrical capsules arising from a persistent, felty-green protonema.

A common species of moist, fine-textured mineral soils in sun or partial shade. Regularly found on eroding river banks, on tip-up mounds and root plates, in road cuts and gravel pits, and on the banks of wood roads. The plant grows from a mat of felty-green, persistent protonema. The gametophytes are tiny, the capsules full size.





F
Identifiable in field

C
Common in right habitat

Protonema with small leafy gametophytes (circled).

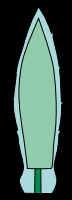
Protonema, gametophytes, young sporophytes with calyptras. Some *Ditrichum* mixed in.

POGONATUM PENSILVANICUM

POGONATUM URNIGERUM Stiff-leaved plants resembling *Polytrichum* but with the leaves shorter and broader, often blue-green; uppermost cells of the lamellae papillose and pointed at the tip rather than flat-topped; capsules cylindrical; leaf sheaths with a clear border.

A common species at high elevations, where it is seen on exposed soil, along trails, and in crevices in rocks. Also found casually at low elevations, on exposed mineral soil on roadside banks, in gravel pits, and along power lines. The diagnostic characters, all microscopic, are the clear borders to the sheaths and tall terminal cells of the lamellae, whose cell cavities are often somewhat pentagonal. The closely related *P. dentatum* is a northern species that occurs mostly at high elevations, but is found at low elevations in the north and along the coast. It lacks a clear border to the sheath, and has lower, more flattened terminal cells on the lamellae.

cylindrical capsules

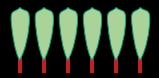


broadly lanceolate, blue-green leaves with clear borders to the sheaths

terminal cells of the lamellae high, with pentagonal cell cavities

Alpine zone

Open soil



Groves

C

Common in right habitat

Microscope needed

Broader and more blue-green than *Polytrichum* or *Polytrichastrum*, with large and more conspicuous teeth.

With *Atrichum undulatum*.

POHLIA Small mosses with lanceolate, toothed leaves with oblong cells and no borders and capsules with necks.

annotina, with brood bodies

C

Common in right habitat

bulbifera, with brood bodies

C

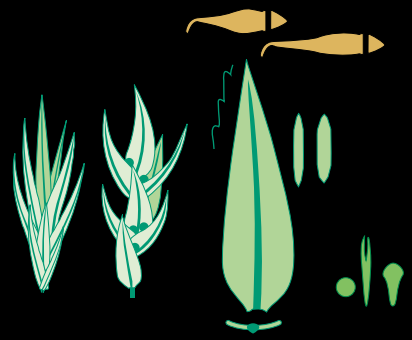
Common in right habitat

cruda

C

Common in right habitat

A common genus of small, often weedy mosses that grow erect in small tufts and have lanceolate leaves with low teeth and medium-sized, oblong-rhombic cells. The long-necked capsules resemble those of *Bryum* but the leaves are unbordered. Red stems, various sorts of brood bodies, and leaves with a metallic sheen are common in the genus. Accurate identification, even of the common species, requires a microscope.



Lanceolate toothed leaves, oblong cells, long-necked capsules, often with brood bodies

nutans

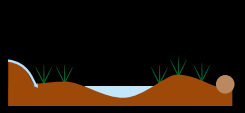
C

Common in right habitat

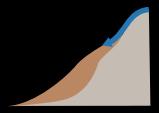
wahlenbergii

U

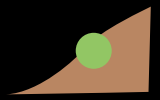
Uncommon



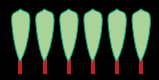
Open wetland



Dirty wet ledges



Soil bank



Groves

Small cushions

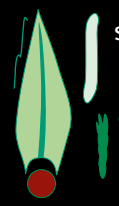
M

Must know

Microscope needed

POHLIA ANNOTINA Small plants with slender brood branches in the upper axils; each brood branch with 3 or 4 leaf primordia near tip.

A small, light green, translucent moss, difficult to photograph clearly, found on moist mineral soil. It is inconspicuous but locally frequent on road banks, disturbed soil, and occasionally in seepage in cracks of rocks. The leaves are typical *Pohlia* leaves, slender, unbordered, and weakly toothed, but not distinctive. The cells are relatively long and thin walled. The distinguishing feature is the cluster of tiny brood bodies in the upper axils, which give the shoots a minutely frizzy appearance. The brood bodies are elongate with three or more tiny leaf primordia at their tips. The related *Pohlia proligera* is similar but has only one or two leaf primordia on the brood bodies, and is said to be shinier.

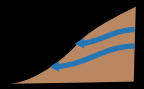


slender cells

brood bodies with 3 to 5 leaf primordia

dioicous, capsules rarely seen

Open soil



Seepy bank

Tufts

F

Identifiable in field

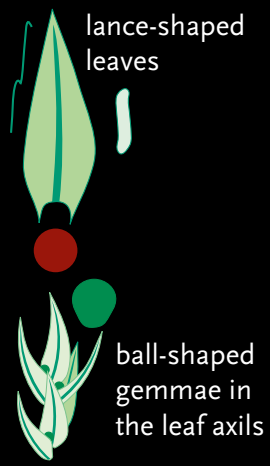
C

Common in right habitat

Red stems, lanceolate, costate leaves with small teeth.

POHLIA BULBIFERA Small plants with red stems, lanceolate costate leaves, and ball-shaped gemmae in axils.

Small, slender glossy plants with round gemmae (consisting of a stem with a couple of leaves rolled in over its tip) in the leaf axils. Found mostly in moist, open disturbed soil: road edges, gravel pits, etc. The gemmae are the diagnostic character. Without them, the plants are just small, nondescript *Pohlias*.



F
Identifiable in field

C
Common in right habitat

Small light-green plants on open soil, with lanceolate leaves with round bodies in leaf axils; the leaves subtending the brood bodies spread widely.

POHLIA CRUDA Small species of rock crevices, blue-green and iridescent in daylight; leaves lanceolate and costate, with long thin-walled cells.

Small pale shiny plants with a metallic iridescence, fond of dirty crevices in limy rocks and places with limy seepage. Identifiable in the field from the pale color and metallic iridescence. *Pohlia nutans* grows in similar places and has some iridescence as well. In the field it is yellower green and grows in denser clumps than *cruda*. Under the microscope its cells are shorter and thicker walled.

Rocks by water

Calcareous seepage

Tufts

F

Identifiable in field

C

Common in right habitat

Red stems; slender pale iridescent blue-green leaves.

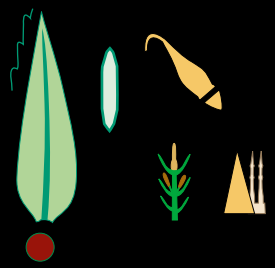
In turfs or small mounds, as here, or as scattered shoots among other species.

POHLIA NUTANS Lanceolate costate leaves with thick-walled cells; nodding capsules with endostomal segments well developed.

Sterile plants are typically shiny, and have thick-walled cells. They are extremely common, but cannot be identified with certainty.

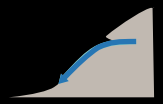
Capsules may have short or long necks

An abundant moss of rocks and soil banks at all elevations, forming dense, dark, nondescript mounds or cushions. Critical features are the thick-walled cells and the long-necked capsules with well developed endostomal segments and cilia.

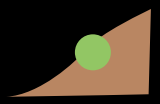


Cells thick walled, capsules with long necks, inner peristome well developed, brood bodies absent

Alpine zone



Seepy ledge



Soil bank

Small cushions

C

Common in right habitat

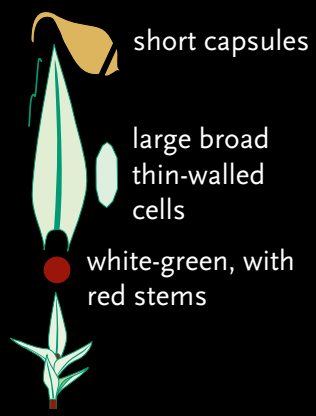
Microscope needed

Leaves lanceolate, with strong teeth; stems and setae red.

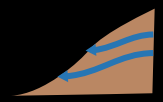
Several other sterile Pohlias look pretty much the same.

POHLIA WAHLENBERGII Pale or white-green plants with red stems and large thin-walled cells.

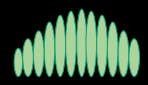
Pale skinny plants with red stems in clumps in wetlands; capsules short, cells thin walled and wide. Very similar in the field to *Philonotis fontana*, which grows in similar places. *Philonotis* has longer, more needlelike leaf tips and narrower cells that protrude at their ends.



Open wetland



Seepy bank



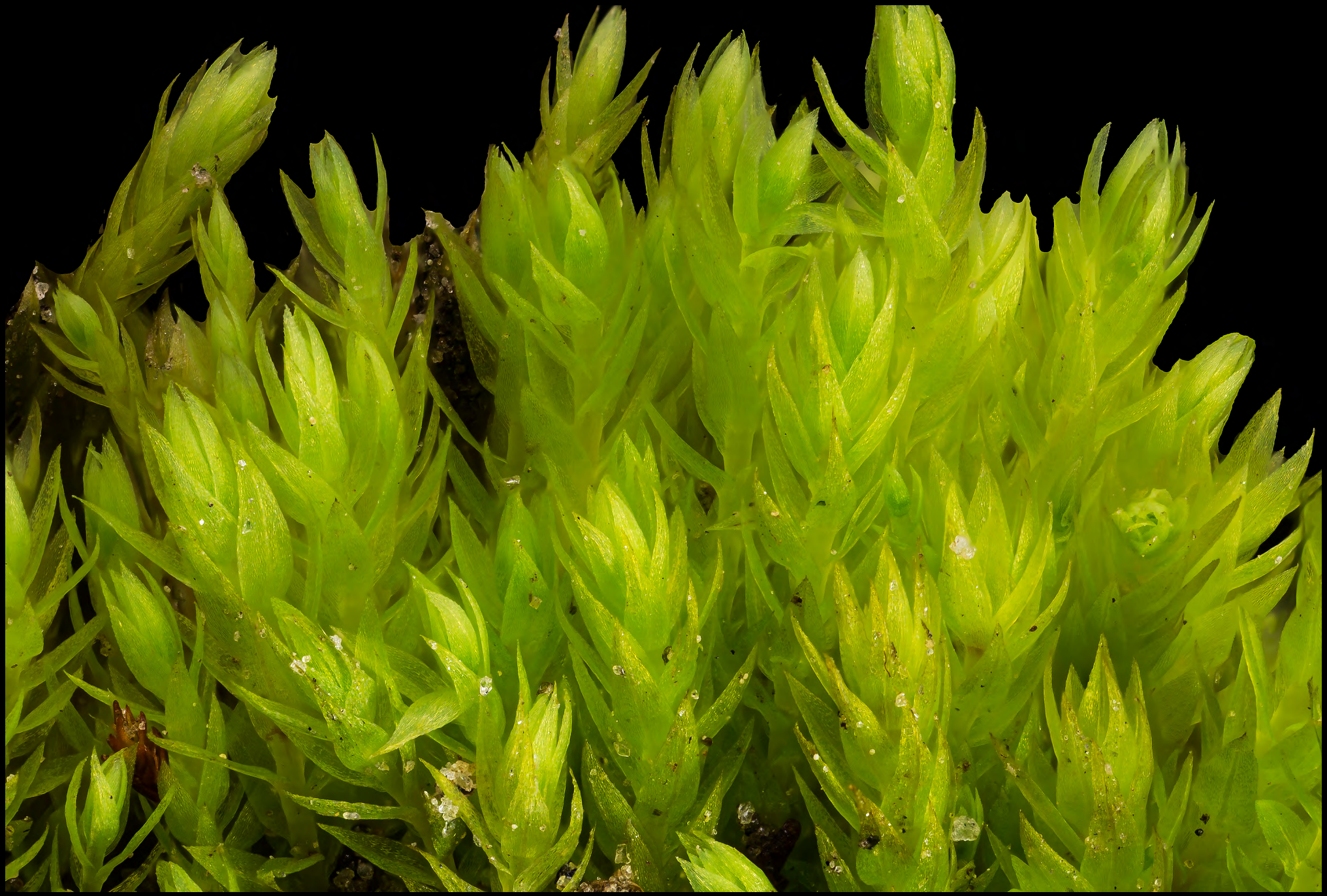
Loose mounds

U

Uncommon

Microscope needed

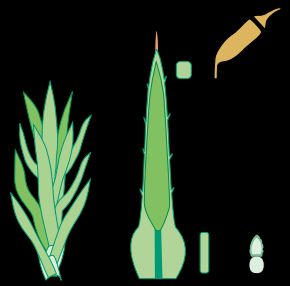
Pale leaves with relatively short tips; red, mostly unbranched stems; in loose clumps or doormats.



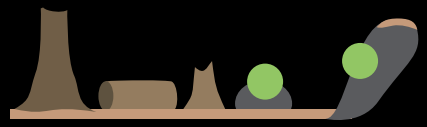
Cells large, leaves with a metallic sheen.

POLYTRICHASTRUM ALPINUM Opaque, slenderly lanceolate leaves ending in needle tips; capsules cylindrical; top cells of lamellae papillose and very thick walled.

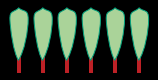
A common species of ledges in cool moist woods, very similar to *Polytrichum commune* and *pallidisetum* but with cylindrical capsules (no ridges or angles) and papillose cells at the edge of the lamellae. *Pogonatum dentatum* and *urnigerum* have similar capsules and edge-cells, though with thinner walls, and shorter, broader leaves that are often more blue-green.



LIke *Polytrichum* or *Pogonatum*, but with cylindrical capsules and thick-walled papillose cells on the edges of the lamellae



Shaded boulders and ledges



Groves

Must know

Microscope needed

Long slender dark-green leaves, cylindrical capsules without angles or ridges.

Often on rocks or soil over rocks, with or without seepage.

Commonly makes loose mounds or cushions.

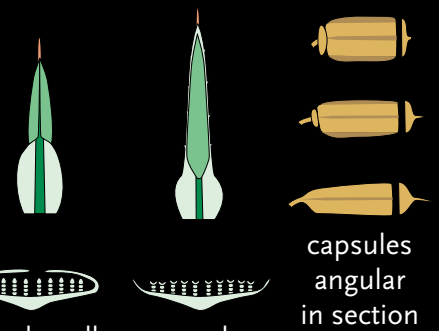
POLYTRICHUM Opaque, needle-like leaves with lamellae, capsules angled, terminal cells of lamellae not papillose.

commune Must know

juniperinum Must know

longisetum Rare

Large or medium mosses with opaque needle leaves covered by vertical photosynthetic ridges (lamellae). Common on rocks, forest floors, rocky barrens,and hummocks in swamps. Our species have angled capsules and smooth rather than papilllose cells on the upper edge of the lamellae, distinguishing them from the related, and often similar-appearing genera *Pogonatum* and *Polytrichastrum*.



ohioense

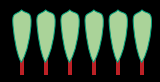
Common in right habitat

pallidisetum

Common in right habitat

piliferum

Must know

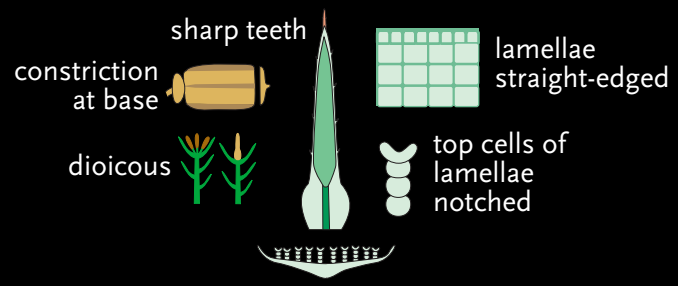


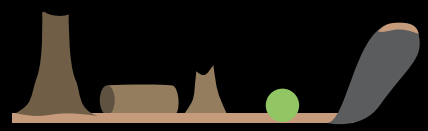
Groves

Must know

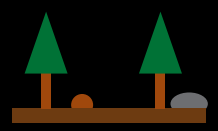
POLYTRICHUM COMMUNE Thick, needle-like leaves with small sharp teeth along the edges; lamellae exposed; top cells of lamellae notched, capsules constricted at base.

Common, and locally dominant, making groves or mounds in open forests, clearings, and wetlands. The leaves have needle tips and toothed edges, the lamellae are exposed and their top cells are notched in cross section, and the capsules are angled and have a constriction at the base. *Polytrichum ohioense, Polytrichum pallidisetum,* and *Polytrichastrum alpinum* have macroscopically similar leaves, and must be distinguished by their capsules or by leaf cross sections.



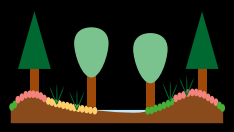


Mineral soil in forests



Boreal forest

Open wetland



Swamp

Groves

Must know

Microscope needed

Large groves of erect plants with slender, toothed leaves, here in open forest with vascular plants. The *Polytrichum pallidisetum group* looks similar vegetatively and can only be separated by the capsules or with the microscope.

Stem with antheridial cup

Constricted base is diagnostic

Silky calyptra

Antheridial cup of reduced leaves; the wavy lines are the lamellae.

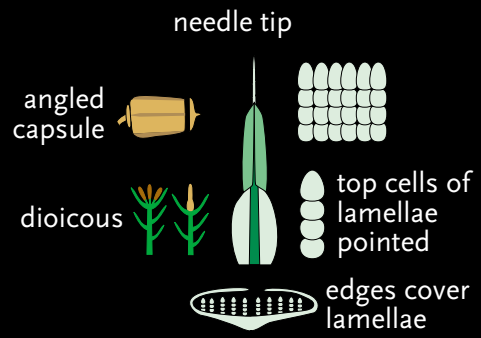
Often grows in meadows and in second growth; can make deep tangled mats.

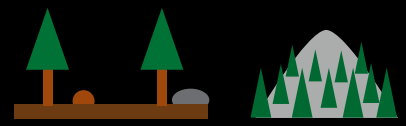
In a mowed lawn, with *Rhytidiadelphus triquetrus.*

New and old capsules; the mature capsules are short and sharply angled and have a constriction at the base.

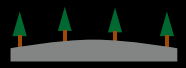
POLYTRICHUM JUNIPERINUM Slender opaque leaves with red needle tips and inrolled edges that cover the lamellae. There is some roughness on the needle tips but no teeth on the main part of the leaf.

Common species of dry open soil, found on rocks, ledge-tops, and in dry open forests, often with *Hypnum imponens* or *Pleurozium schreberi*. Easily recognized in the field: generally like *Polytrichum commune*, but shinier, often bluer, and always with the lamellae covered by the inrolled leaf edges and a strong, dark-red needle tip. *Commune* has teeth, *juniperinum* doesn't. *Polytrichum piliferum* which can grow with *commune* on dry sites, has white hair tips.



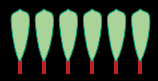

Boreal forest

Alpine zone


Rocky barren

Acid ledge

Open disturbed soil


Groves

M
Must know

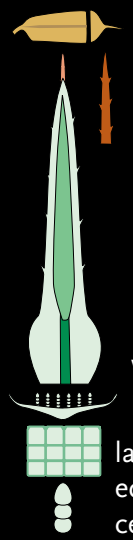
In an open mat, mixed with *Pleurozium schreberi*. Plants blue green and shiny; lamellae covered by the leaf edges.

Moist and dry; unlike the *commune* group, there are no teeth on the leaf edges.

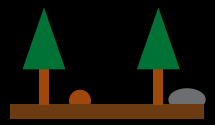
Sterile *juniperinum* growing with male plants of *piliferum*, just after snowmelt; everything is speckled with lichen soredia.

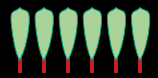
POLYTRICHUM LONGISETUM Like *pallidisetum* but with the edges of the lamellae flat rather than scalloped; border of leaves often wide, inrolled on dry leaves.

A northern species of cool forests, wetlands, and tundra, rare with us. Similar in the field to *pallidisetum*, from which it is separated by the lamellae, which have straight edges without scalloping and terminal cells that average a bit higher than wide. Sometimes recognizable by wide borders on the leaves.



Open wetland


Boreal forest


Groves

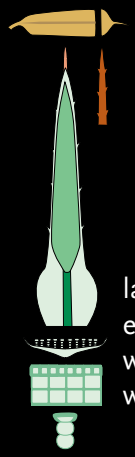
R
Rare

Microscope needed

Sterile plants much like *commune* or *pallidisetum*; leaves may have broad borders.

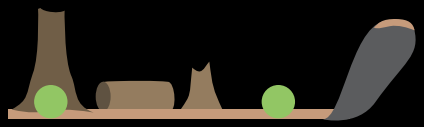
POLYTRICHUM OHIOENSE Leaves toothed, lamellae not covered by leaf edges; top cells of the lamellae flat-topped, with thick walls; capsules four-angled, not constricted at base.

Common on forest floors in the oak zone: plants relatively short, lamellae exposed, capsules angled but not constricted at base, edge cells of the lamellae thick walled and flattened. *Commune* has short capsules with constricted bases and notched cells on the edges of the lamellae. *Pallidisetum* has thin-walled cells on the lamellae edges.

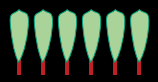


four-angled capsules, not constricted at base

lamellae with flat edges and thick-walled terminal cells with flat tops



Tree bases, mineral soil in forests



Groves

C

Common in right habitat

Microscope needed

Plants often short and treelike, with leafless stems.

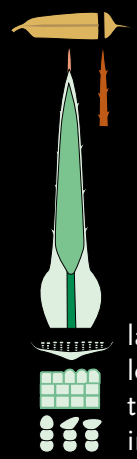
Leaves clearly toothed, plants short, leaf borders not conspicuous.

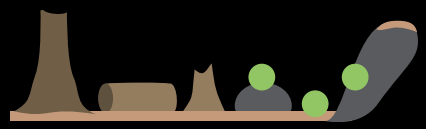
Short capsules with angles but no basal constriction; hairy calyptras.

POLYTRICHUM PALLIDISETUM Thick, needle-like leaves with exposed lamellae and conspicuous teeth on the edges; elongate capsules without a constriction just above the base.

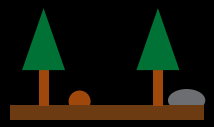
With *Ptilium crista-castrensis.*

A common species in moist northern forests and swamps. Tall, slender leaved, with four-angled capsules that are not constricted at base and lamellae with intermittently scalloped edges. *Ohioense,* the common forest-floor species in the oak zone, is shorter and has thick-walled, flattened cells on the lamellae edge.

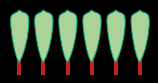




Soil or rocks in forests



Boreal forest



Groves

C

Common in right habitat

Microscope needed

Male plants with splash cups containing antheridia, in moist boreal forest; with *Bazzania trilobata*.

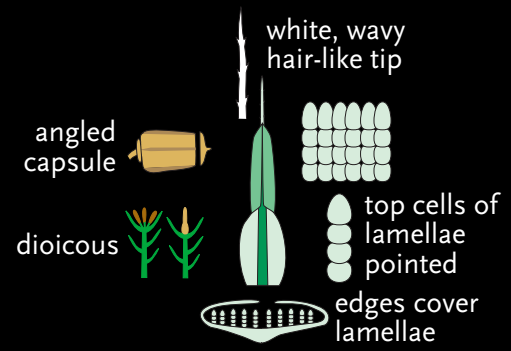
With *Sphagnum girgensohnii*, on the floor of a moist boreal forest; note the slender needles.

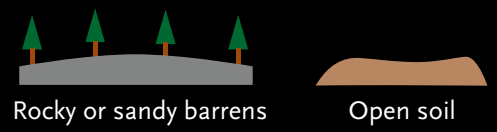
With *Thuidium delicatulum*, on a hardwood forest floor.

Vegetatively similar to *Polytrichastrum alpinum* but less apt to form thick cushions; with *Thuidium delicatulum* and a white cedar seedling.

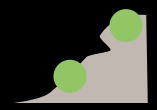
POLYTRICHUM PILIFERUM Small species with inrolled leaf margins and white hairlike tips.

Common in dry habitats, growing in low groves over rocks or thin soil. Immediately recognizable by the thick leaves with inrolled edges and white hairlike tips. Hairlike white tips are found in other genera, particularly *Grimmia* and *Racomitrium*, but the leaves are thinner and the plants don't look treelike.

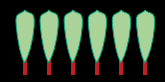




Rocky or sandy barrens Open soil



Acid ledge



Groves

M

Must know

In small groves on dry soil with the squamules of *Cladonia*, a common associate; stubby leaves with long crinkly white tips.

Thick opaque leaves with inrolled edges, hairlike white tips, woolly calyptra.

Male plants with antheridial cups, plus a few scattered plants of *Polytrichum juniperinum*.

On thin soil over rock with *Hedwigia* and *Cladonia cf. mitis*

POLYTRICHUM STRICTUM (*Polytrichum juniperinum* variety *affine*) Like *juniperinum* but tall and skinny; stem often with white or brown fur.

A skinny form of *Polytrichum juniperinum*, with furry stems, common on hummocks in bogs. Treated as a species in the *Flora of North America*, and as an ecological form of *juniperinum* by Bruce Allen in *Maine Mosses.*

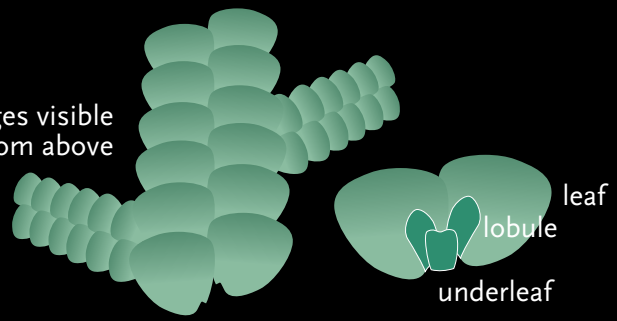
C
Common in right habitat

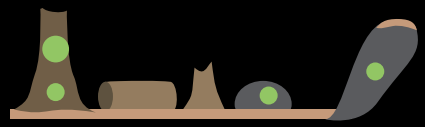
F
Identifiable in field

Short leaves
Tall stems with
tomentum

PORELLA PLATYPHYLLOIDEA Large pinnately branched liverwort making loose, shaggy fringes.

Common on tree bark and occasionally logs in old, primary forests, where it curves out from the bark and makes loose, shaggy fringes. The combination of large size and pinnate branching is unique. Also common on shaded limy boulders and ledges. Genetically complex and can be treated as a mixture of (at least) two North American species, *platyphylla* and *platyphylloidea,* separated by the relative size of lobules and underleaves.





Forest interior

Shingles

C Common in right habitat

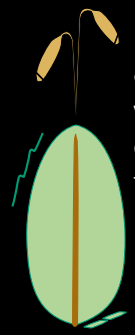
M Must know

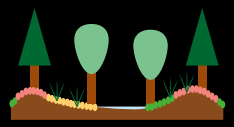
From below. Zoom to see the lobules and underleaves.

On a sugar maple; shingled leaves, olive-green color, dull surface, pinnate branching. The tiny moss may be *Platydictya subtilis.*

PSEUDOBRYUM CINCLIDIOIDES Large, sparsely-branched mosses, resembling *Rhizomnium,* but with oval leaves with a weak border and inconspicuous teeth.

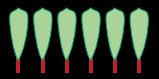
A large distinctive moss with oval leaves with large, obliquely oriented, rhombic cells, thin weak borders and a few low, blunt teeth. Occasional in shaded pools in wooded swamps, sometimes on wet ledges. Similar, especially in the field, to *Rhizomnium appalachianum*, and grows in the same places. *Rhizomnium* has rounder leaves with strong, thickened borders, and no teeth whatever.





Swamp

Open wetland



Groves

C

Common in right habitat

M

Must know

Large plants, dark green at maturity; oval leaves with large cells, thin weak borders, and small teeth.

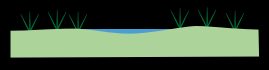
New foliage; plants resemble *Rhizomnium appalachianum* or *Plagiomnium medium* but have only weak inconspicuous borders. With *Sphagnum squarrosum*.

PSEUDOCALLIERGON Medium-sized wormlike mosses with concave, closely overlapping leaves, Costas short or long, tips rounded or pointed.

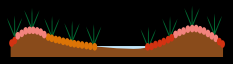
trifarium

turgescens

Northern mosses of rich fens and alvars with wormlike shoots and broad, concave, closely overlapping leaves. The species are identifiable in the field, but care is needed. *Scorpidium scorpioides* is similar, but has curved, secund leaves with longer points near the tips of the branches.

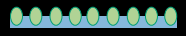


Alvar



Calcareous fen

Scattered



Loose wet mat

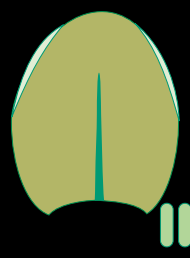
F Identifiable in field

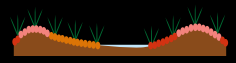
R Rare

Microscope needed

PSEUDOCALLIERGON TRIFARIUM Sparsely branched and wormlike, with broadly oval, costate leaves with rounded tips; alar cells slightly enlarged.

A rare species of rich fens, associated with species like *Campylium stellatum*, *Helodium blandowii*, *Calliergonella cuspidata*, and *Scorpidium scorpioides*. Its marks are the cylindrical shoots and the broad blunt concave leaves with a short costa and enlarged alar cells.





Calcareous fen

Scattered

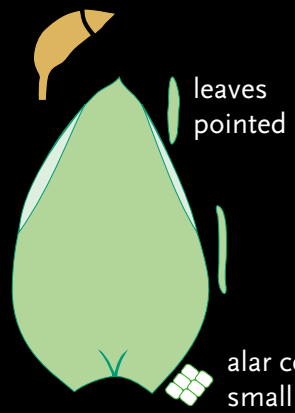
F Identifiable in field

R Rare

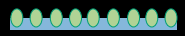
Microscope needed

PSEUDOCALLIERGON TURGESCENS Medium-sized, golden brown or deep brown, with wormlike shoots and concave, closely overlapping leaves with short double costas and short points; leaf tips not curved, alar cells not inflated.

A rare moss of limy pools in flat-rock barrens, forming mats where seepage enters the pools. Like *Pseudocalliergon trifarium,* it has cylindrical shoots and broad concave leaves. It differs in the pointed tips of the leaves, short double costa, and small alar cells. *Scorpidium scorpioides* looks similar but typically has longer curved leaf tips and a small group of inflated alar cells.



Alvar



Loose wet mat

F Identifiable in field

R Rare

Microscope needed

PSEUDOCALLIERGON TURGESCENS

Yellow-green to golden brown; wormlike; concave ecostate leaves with short points.

In a flat mat in an alvar on dolomite, catching seepage emerging from a vegetated hummock; the small mosses are a *Bryum* and *Ditrichum*.

PSEUDOTAXIPHYLLUM Small, shiny, mat-forming, with somewhat flattened shoots and shiny, nondecurrent leaves with short double costas; brood branches often present in the leaf axils and are the easiest way to identify the genus; alar cells undifferentiated; outer stem cells thick walled.

Two slender shiny mosses with short double costas that are neither decurrent nor have strongly differentiated alar cells. When the brood branches are present they can be identified in the field; when they are not, the genus has to be identified microscopically, mostly by eliminating other similar genera, particularly *Plagiothecium*, *Herzogiella*, *Isopterygiopsis*, *Pylaisiadelpha*, and *Taxiphyllum*.

distichaceum

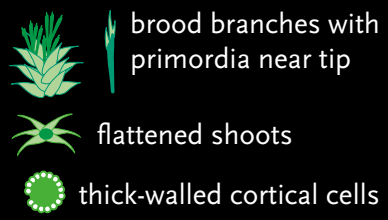
C

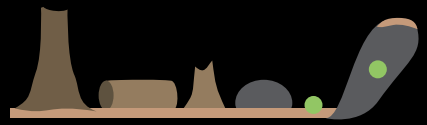
Common in right habitat

elegans

U

Uncommon





Forest interior

Low flat mat

PSEUDOTAXIPHYLLUM DISTICHACEUM Small, shiny, mat-forming, with somewhat flattened shoots, and down-curved asymmetrical leaves; brood branches with leaf primordia near their tips, located in the upper leaf axils near the stem tips.

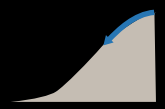
A relatively common species of moist shaded rocks and thin soil over rocks. It is characterized by flattened shoots with asymmetrical, often somewhat widely spaced leaves, leaf tips that point downwards, stems with thick-walled cortical cells, and elongate brood branches in the upper axils. Plants with brood bodies can be recognized in the field; plants without them need the microscope.

brood branches with primordia near tip

flattened shoots

thick-walled cortical cells

asymmetrical leaves with a few teeth near tip



Wet ledge

Forested stream

Low flat mat

F

Identifiable in field

C

Common in right habitat

Microscope needed

Small plants, narrow shiny down-curled leaves, somewhat flattened branches, brood branches in upper axils.

Plants without brood branches resemble *Plagiothecium* or *Herzogiella*.

Shoots flattened, leaves asymmetric and spaced out, brood bodies (circles) often present.

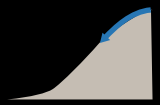
Thin, flat, shiny mats on soil, generally near rock.

PSEUDOTAXIPHYLLUM ELEGANS Like *distichaceum* but the brood branches in the axils of the middle leaves, the leaves more symmetrical, and the leaf primordia spaced out along the stems of the brood branches.

Pseudotaxiphyllum elegans is very similar to *distichaceum* and grows in the same sort of places. The brood bodies are the best distinction. In *distichaceum* they are at the tips of the stems, and have leaf primordia only at their tips. In *elegans* they are in the leaf axils and have primordia along their sides. Lacking brood bodies you can use the symmetry of the leaves and length of the leaf tips. The brood bodies are better.

symmetrical leaves with long tips

brood branches in leaf axils below tip of stem



Wet ledge

Forested stream

Low flat mat

F

Identifiable in field

C

Common in right habitat

Microscope needed

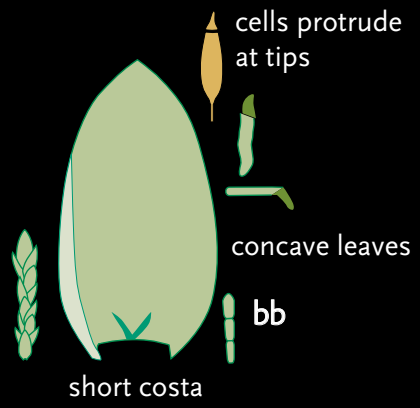
Shoots flattened, leaves asymmetric and spaced out, with long tips; the divergent middle leaves suggest that brood branches may be present, but they are not visible in the photo.

Shoots flattened, leaves asymmetric; very like *Plagiothecium* or *Herzogiella*; microscope needed.

Shoots flattened, thin shiny mats on soil.

PTERIGYNANDRUM FILIFORME Small moss with spoon-shaped leaves, making thin mats on rocks; cells protrude at the tips.

Small, dark, reasonably common, on rocks in shade. Stems stringy, making thin mats; leaves concave and spoon shaped, with rounded tips or short-pointed; cells long and protruding at tips; alar cells not differentiated. Often grows with *Homomallium adnatum* which is about the same size but has shinier leaves with longer tips.



Rocks tree bases

Low flat mat

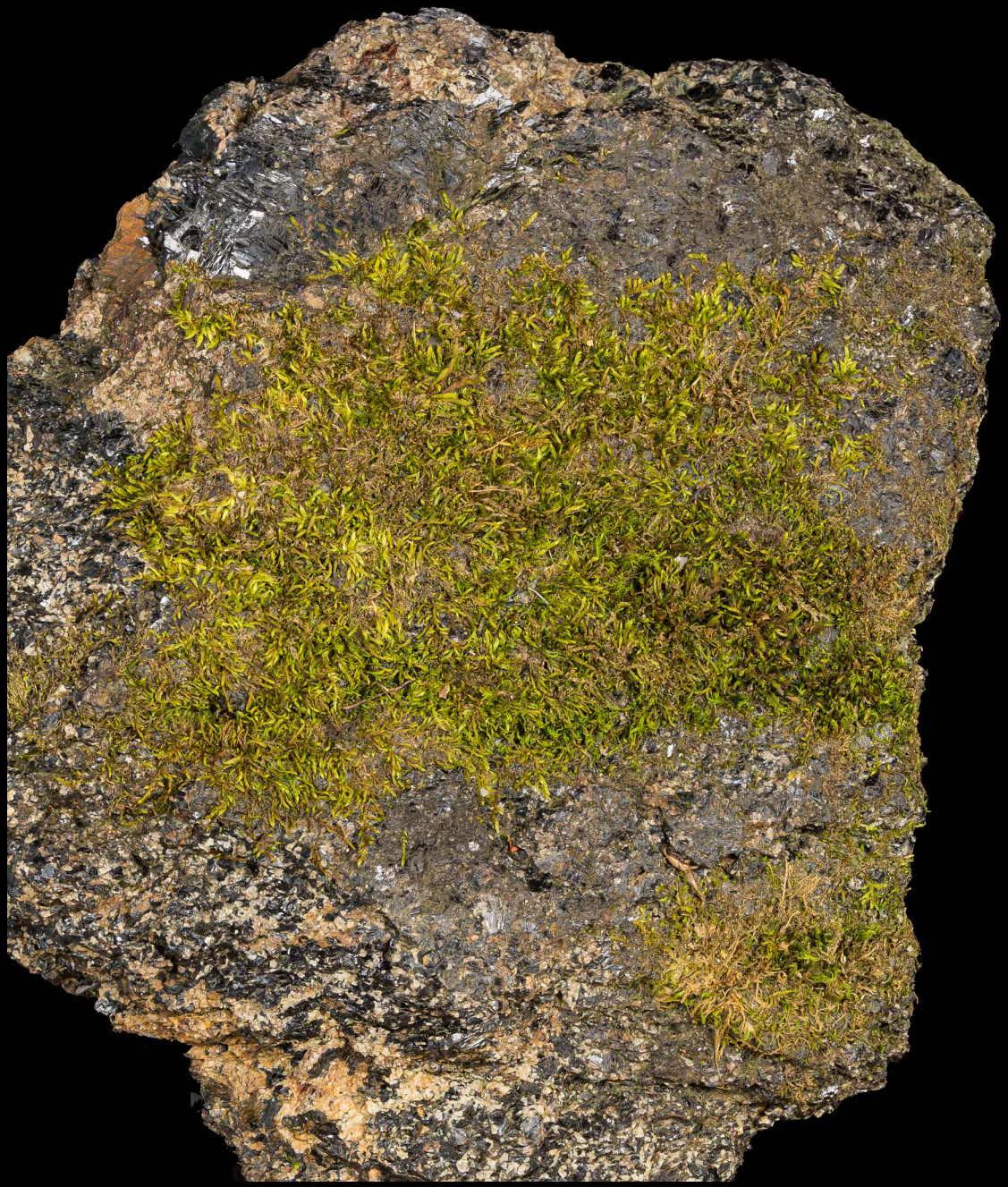
F Identifiable in field

C Common in right habitat

Branches club shaped; leaves papillose, dull, rounded or with short points.

Shoots of *Pterigynandrum* (Pt) in a mat of *Homomallium* (Ho). The two are similar in the field, and often grow together.

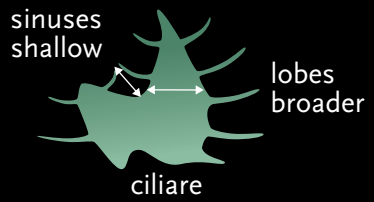
Stems sometimes red; branches club shaped; leaves dull, with short points. There is some *Homomallium* here too.

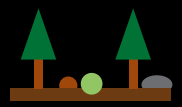


A mixture of *Homomallium adnatum* (large shiny, bright tips) and *Pterigynandrum filiforme* on a small piece of amphibolite. Both can grow on small rocks that are too dry for larger mosses.

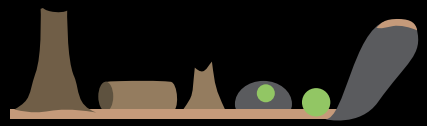
PTILIDIUM CILIARE Erect, pinnately branched, like stick figures made from wool; leaves shallowly lobed, lobes broad at base.

A common liverwort of the boreal forest floor, growing erect and forming deep, loose, brown or green mats on dry soil or exposed rock. The leaves are lobed and have long marginal projections (cilia) that make the plants look woolly. This and the related, but much more widespread *Ptilidium pulcherrimum* are our only large upland liverworts that look woolly or cottony. (*Trichocolea tomentella,* a wetland species, also looks cottony.) The leaves of *ciliare* are less deeply lobed and broader at their bases than those of *pulcherrimum*, and the plants are erect rather than creeping.





Boreal forest



Forest interior

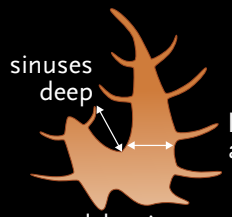
Pipe cleaners

M

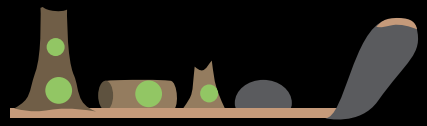
Must know

PTILIDIUM PULCHERRIMUM Low, mat-forming liverwort, in low dense mats, often golden or reddish, almost always on wood.

A related but more widespread species, common on logs and decayed wood, variously green, brown or reddish, making low, woolly, interwoven, mats. Leaf lobes longer and narrower than those of *ciliare*, and the plants creeping rather than erect.



pulcherrimum

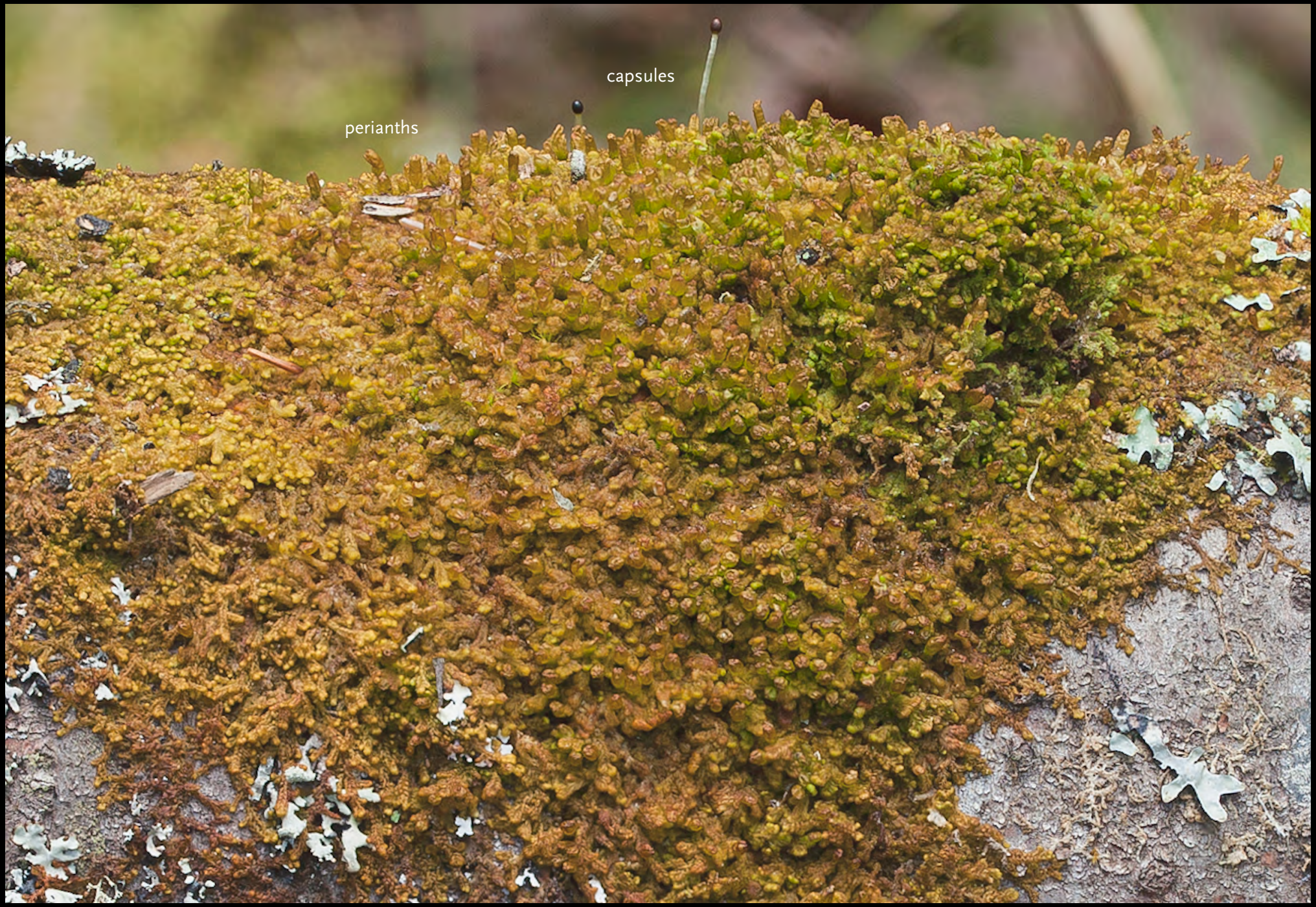


Forest interior

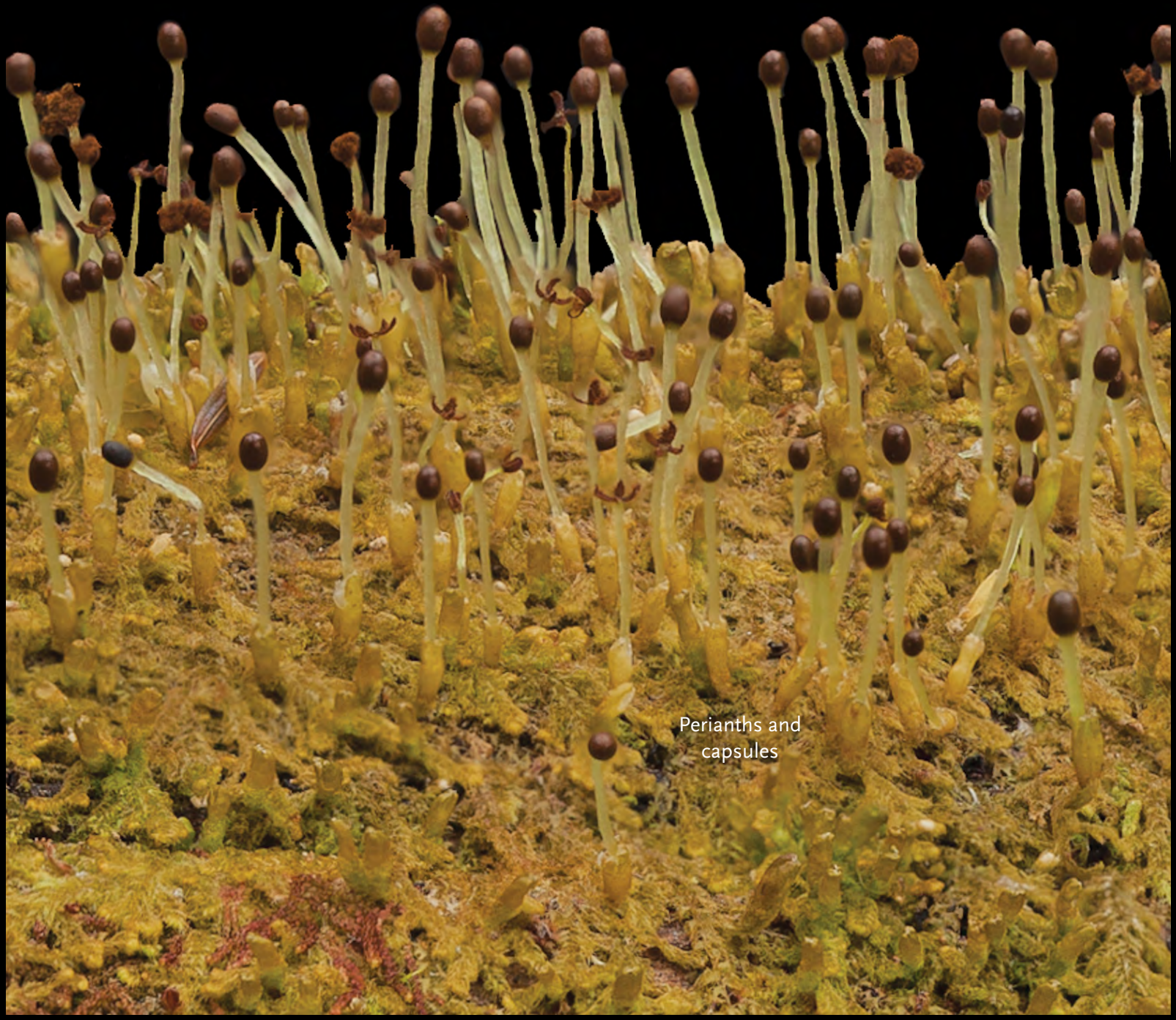
Low flat mat

C Common in right habitat

M Must know

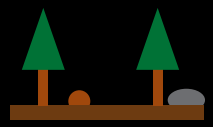


On a recently-fallen log, with creeping vegetative branches and short erect ones with perianths and new capsules. Often fruits abundantly.

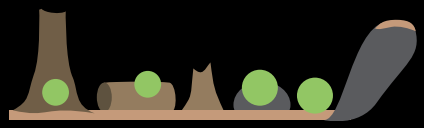

Perianths and
capsules

PTILIUM CRISTA-CASTRENSIS Large, erect, regularly pinnate, light silvery green, with pleated leaves with long, hooked tips.

Large common moss of the ground layer of boreal forests, growing in pure stands over soil, rocks, and logs, or mixed with *Pleurozium, Hypnum imponens, Dicranum polysetum,* or *Polytrichums.* Immediately recognizable from the light-colored, erect, fern-like fronds and long pleated leaves that all curve in one direction.



Boreal forest



Forest interior

Erect fronds

M

Must know

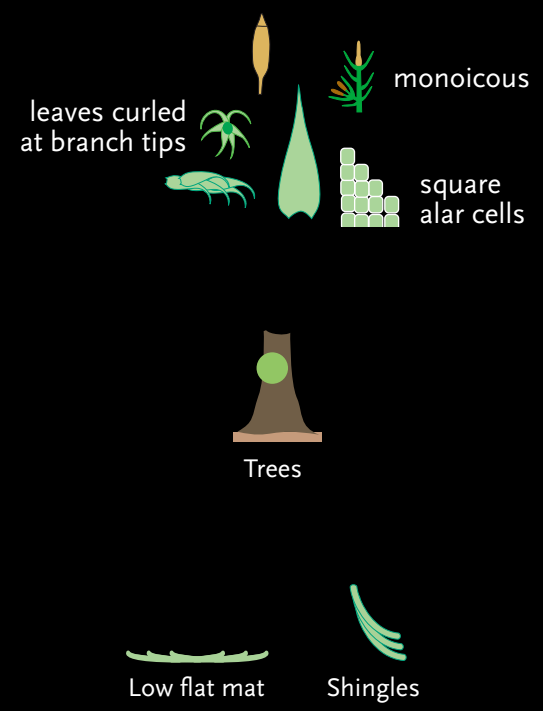
In a mixed mat on boreal forest floor with *Polytrichum*, *Pleurozium*, and two *Dicranums*.

Erect or arching fronds, hooked leaves.

Yellowed fronds in late winter, with *Thuidium delicatulum* and *Dicranum scoparium*.

PYLAISIA SELWYNII GROUP Small, curly branched, making mats or fringes on tree bark; slender leaves with short double costas and small, square alar cells; erect capsules; stems with a central strand.

Two or three closely related species, best separated by microscopic details of the leaves, making mats or shingles on tree bark. Generally common in our area, often making large, conspicuous patches. Plants usually light shiny green, with small, slender-tipped leaves, resembling *Platygyrium repens* but without brood branches and often with short curled branches forming windrows or shingles.



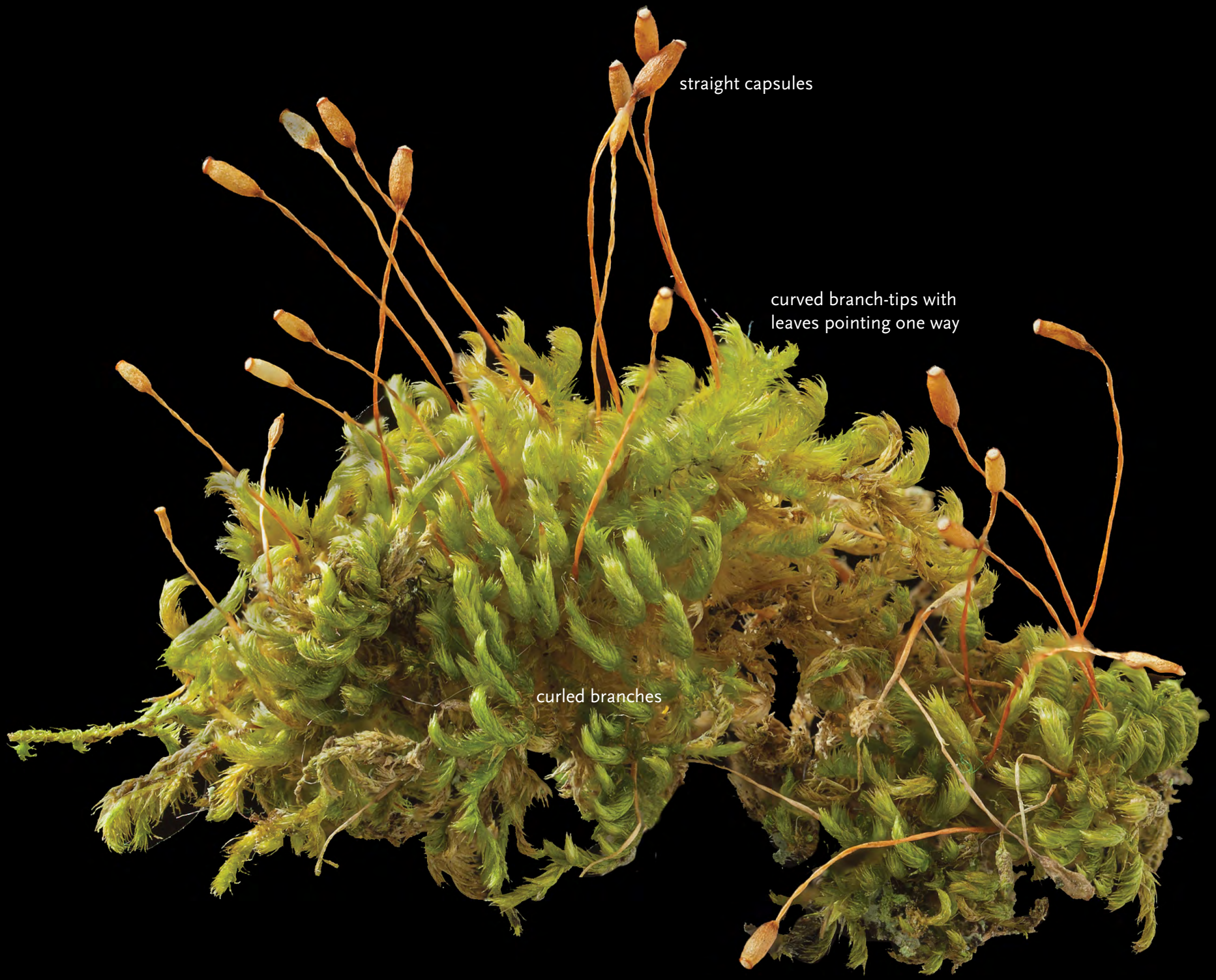
C Common in right habitat

M Must know

Microscope needed

Pinnately branched, with the secondary branches curling upwards.

Thin mats, with short branches curling upwards.

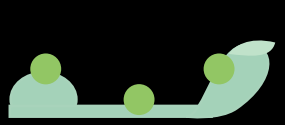

straight capsules
curved branch-tips with
leaves pointing one way
curled branches

PYLAISIADELPHA TENUIROSTRIS Small, shiny, somewhat variable; leaves with slender tips and several large inflated alar cells; pseudoparaphyllia slender.

Stringy, *Hypnum*-like form

Flattened, *Plagiothecium*-like form

Small, slender moss with long-tipped, ecostate leaves, growing in small mats or tufts on limy rocks. Also reported on trees. Best recognized microscopically: it has small teeth and a small group of strongly inflated alar cells bordered by a larger group of rectangular cells that extend up the margin. Shoots may be terete (leaves all around) and resemble a small *Hypnum*, or flattened, resembling a small *Plagiothecium*.



Calcareous rocks or soil

Trees

Low flat mat

Uncommon

Microscope needed

Small size, light color, slender leaves with long tips; with *Metzgeria*.

Small *Pylaisiadelpha tenuirostris* (Py) mixed with larger, flatter stems that are probably *Pseudotaxiphyllum distichaceum* (Ps). In this kind of situation, trust only the microscope.

RACOMITRIUM Dark shaggy mosses, with many short side branches, on rocks and soil; cells with wavy sides; leaves often with white needle tips; capsules with a beak.

Dark mosses with lanceolate leaves, commonly making cushions or patches on rocks, often much branched, often with white needle tips. Separated from all our other genera by the extremely wavy walls to the cells. Related to *Grimmia* and *Schistidium* and often growing with them; usually separable in the field by the abundant side branches and often looser growth of *Racomitrium*.

C

aciculare Common in right habitat

C

aduncoides Common in right habitat

R

canescens Rare

U

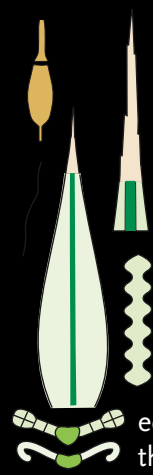
fasciculare Uncommon

R

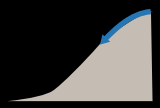
lanuginosum Rare

C

venustum group Common in right habitat



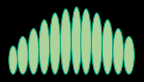
Rocks by water



Wet ledge

Large cushions

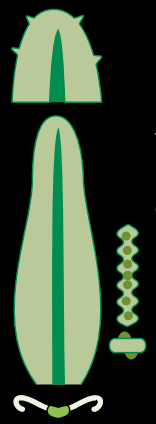
Loose thatch



Loose mounds

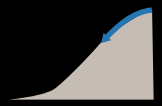
RACOMITRIUM ACICULARE Small dark shaggy moss on wet rocks; leaf tips rounded; costa ends near tip; leaves keeled.

A common species of shaded rocks in the splash-zone of streams, with oblong leaves with rounded tips and recurved edges. Under the microscope the cells are typical wavy-edged *Racomitrium* cells and the costa nearly reaches the tip. *Racomitrium aduncoides* has more pointed tips and shorter costas.



tips broadly rounded; costa ends near tip

Rocks by water



Wet ledge

Loose thatch

F Identifiable in field

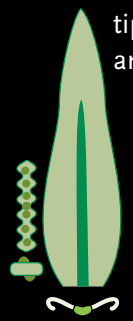
C Common in right habitat

Microscope needed

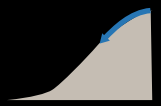
Small, blunt-tipped, dark, shaggy. *Schistidium rivulare* and *Racomitrium aduncoides* have sharper tips.

RACOMITRIUM ADUNCOIDES Like *Racomitrium aciculare* but with narrower, inrolled tips and the costa ending well below the tip.

A new species, growing in the same habitats as *aciculare* and identical superficially. The only differences are that the leaf tips are narrower and the costa shorter.



Rocks by water


Wet ledge

Loose thatch

F Identifiable in field

C Common in right habitat

Microscope needed

Pointed tips, short costas, lots of short branches, long erect exserted capsules.

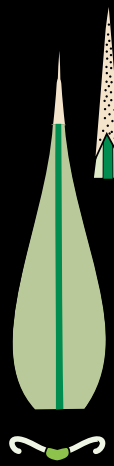
Compare *Schistidium rivulare*, with sharper needle tips and capsules surrounded by leaves.

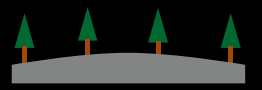
RACOMITRIUM ADUNCOIDES

RACOMITRIUM CANESCENS Gray-green when fresh, whitened when dry; leaves with white hair points; cells and hair points with tall papillae.

photos from a faded specimen; gray-green when live

A northern species of bare sand, gravel, and exposed rocks. Widely distributed but not common anywhere in the NFR. Medium sized, olive or yellow-green, whitened when dry, with white leaf tips that are finely toothed. Under the microscope the long papillose leaf tips and the tall papillae over the leaf cells are unique. *Lanuginosum* is bigger and woollier, with longer, more sharply toothed tips.





Rocky or sandy barrens

Alpine zone

Loose thatch

F

Identifiable in field

R

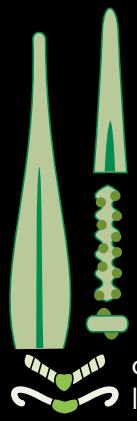
Rare

Microscope needed

Leaves with long white papillose hair points; cells papillose with high papillae.

RACOMITRIUM FASCICULARE Leaves with slender points that are rounded at the extreme tips; no hair points; costa short; cells papillose; margins not thickened.

A northern and uncommon species in the NFR. On wet rocks by lakes and streams at low elevations and on exposed rocks in the alpine zone. Locally common in the Adirondack High Peaks and likely elsewhere at high elevations. Its field marks are long narrow leaf tips without hair points. Confirmed microscopically by the papillose leaf cells, relatively short costa, and one-layered margins.



leaves tapering into a long tip, rounded at the tip, without hair points

costa not reaching tip; cells papillose, in one layer

cells in one layer

Rocks by water

Alpine zone

Loose thatch

F

Identifiable in field

U

Uncommon

Microscope needed

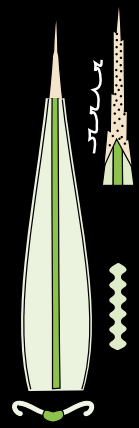
Leaves long and slender, rounded at the extreme tip, without hair points; lots of short side branches.

Often in tangled mats; dark with light tips; many short side branches.

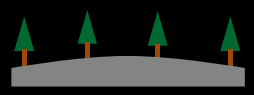
RACOMITRIUM LANUGINOSUM Large moss forming large clumps; gray-green with long white hair tips, looking gray from a distance; hair points toothed and decurrent; cells smooth.

A big moss, rare with us, found on rocky barrens in the arctic and sub-arctic, and on limestone and serpentine southwards. Plants are gray-green, with long white hair points that make them look woolly. The best diagnostic characters are the long hair points, which are papillose and strongly toothed.

Canescens has a similar color but weakly toothed hair points and higher papillae on the cells.



leaves with long, strongly toothed, decurrent hair points



Rocky or sandy barrens

Alpine zone

Large cushions

F

Identifiable in field

R

Rare

Gray-green leaves with long curly white hair points; many short branches.

Dry plants look gray and woolly.

In serpentine barrens with creeping juniper and dwarf birch, Table Mountain, Newfoundland.

Can form dense cushions several meters wide.

RACOMITRIUM VENUSTUM GROUP Dark, branchy plants forming loose mats; cells with wavy edges; leaves with short needle points.

R. venustum

The *venustum* group *(venustum, affine, sudeticum,* and *microcarpon,* formerly included in *heterostichum)* is common on rocks that are intermittently wet, especially on exposed cliffs and summits. They have hair points with teeth but no papillae. They differ from one another in small features of the leaf margins and the perichaetial tips. *R. venustum*, with bistratose, strongly recurved margins and blunt perichaetial leaves, is the common species of exposed rocks. *R. microcarpon*, with rectangular cells up the lower margins and upper margins not thickened, is rare in the mountains.

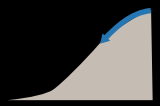
lanceolate leaves, often with hair points which are toothed but not papillose

cells smooth, with wavy edges

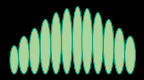
upper margins thickened or not

Alpine zone

Rocks by water



Wet ledge



Loose mounds

Loose thatch

Must know

Microscope needed

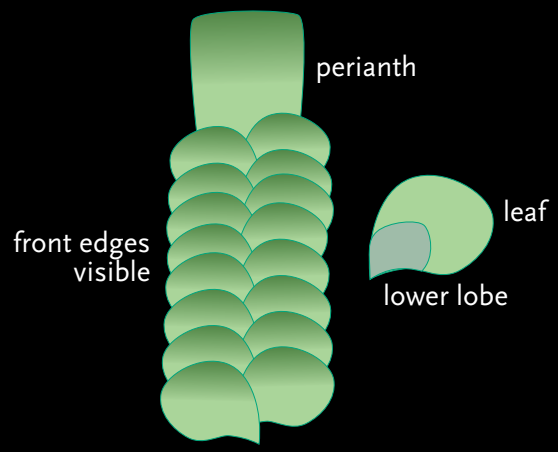
Uncommon species with unistratose margins and rectangular cells, without wavy walls, on the lower margins; these from the alpine zone of Whiteface Mountain, New York.

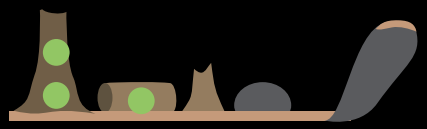
Long white hair tips.

R. venustum, our common species, with recurved bistratose margins.

RADULA COMPLANATA Light green, rounded leaves pointed lower lobes, flattened, trapezoidal perianths often present.

A small but fairly conspicuous liverwort, common in all sorts of forests, making dull, light-green patches on tree bark and logs. Leaves rounded, closely shingled with the front edges visible, with lower lobes with rounded points. The plants are very flat. The equally flat perianths are distinctive.





Forest interior

Low flat mat

The (lovely) small blue lichen is *Normandia pulchella*. It may be rare.

Fruiting clone on tree bark. Closely appressed, like light-green, leafy paint.

Low flat mat

Tree bark

F

Identifiable in field

C

Common in right habitat

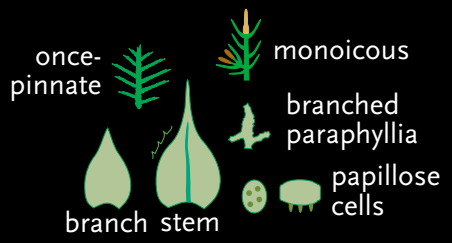
Sterile shoots with gemmae.

With perianths and sporophytes.

RAUIELLA SCITA Small, opaque, once-pinnate, moss of tree trunks; cells multipapillose on lower side, pseudoparaphyllia branched.

Slightly shaggy, loose mats, once pinnate.

Small, dark green or brown, opaque, once pinnate moss, creeping on tree bark or forming thin mats, frequent or locally common in deciduous forests. *Rauiella scita* (*Thuidium scitum*), shown here, has long-tipped stem leaves, branched paraphyllia, and cells that are papillose on the lower side. The closely related *Cyrto-hypnum minutulum* (*Thuidium minutulum*) has shorter tips, unbranched paraphyllia; *Haplocladium* has single-papillose cells which are papillose on both sides. *Leskea*, a common epiphyte, has a similar look but is less pinnate, more stringy, and shorter tipped.



Trees

Low flat mat

U

Uncommon

Microscope needed

Pinnate, stiff, often yellow or brown; on bark with *Phaeophyscia* sp.

Regularly pinnate branching, opaque, papillose leaves. *Hypnum pallescens* is another small pinnate tree-base species, but it is shinier and has no costa.

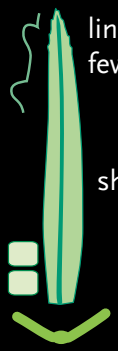
Making mats or traceries. The shiny moss may be *Callicladium*.

Dull thin mats, the shoots small and indistinct until you are close.

RHABDOWEISSIA CRISPATA Small moss with slender leaves and erect furrowed capsules, making mats on rock.

Small moss, reasonably common on shaded moist ledges, making mats or mounds, often in crevices or recesses, usually on acid rock. Leaves linear, fairly flat, with smooth cells and a few separated teeth near the tips. Capsules cup shaped, furrowed when dry, with a peristome of undivided teeth. *Gymnostomum* and *Hymenostylium* look similar in the field; their leaves are papillose and their capsules lack peristomes and furrows.

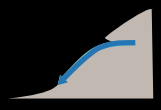
erect furrowed capsules



linear leaves with a few teeth near tip

short square cells

leaf edges flat



Seepy ledge

Low flat mat

Small cushions

F

Identifiable in field

C

Common in right habitat

Microscope needed

Linear leaves, not sharply folded; similar to *Gymnostomum* and *Hymenostylium* but usually on acid rock.

Hard to identify sterile; look for the furrowed capsules!

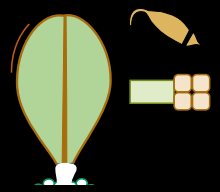
In thin mats or mounds, curly when dry; capsules contracted below the mouth and furrowed when dry, often abundant.

RHIZOMNIUM Erect mosses of wet places; broadly oval, untoothed leaves with hexagonal or rhombic cells and thickened borders.

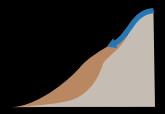
R. appalachianum

R. punctatum

Common, round-leaved mosses with untoothed, strongly bordered leaves, always in wet, or intermittently wet, places. *Appalachianum* is a big plant, often a dominant, found in pools in swamps, with rhizoids on both the stem and leaf bases. *Punctatum* is a small plant of seepy cliffs and rocks in the spray zone of streams, often mixed with other mosses, with rhizoids only on the stem. Compare *Pseudobryum*, a common wetland species, similar to *appalachianum* but with a weak border and low teeth; and *Cinclidium,* rare and northern, with strong points on the leaves, 1-cell thick borders, and rhizoids in lines on the stems.



blunt, broad-oval, untoothed leaves with a thickened border



Dirty wet ledges

Seepy shoreline ledges

Open wetland

Groves

C

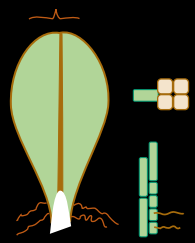
Common in right habitat

M

Must know

RHIZOMNIUM APPALACHIANUM Large plants of wetlands, with rhizoid initials or rhizoids on the bases of the leaves.

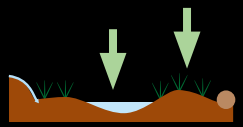
A large, common species of shaded wetlands, particularly common, and sometimes covering large areas, in temporary pools that dry up in the summer. Recognized by the large size— it can be 5 cm high and has the largest leaves of any common terrestrial moss—and by the rhizoid initials (small square cells)along the lower edges of the leaves. We have two other large Rhizomniums but never see them.



rounded leaves with strong borders

rhizoid initials on lower edges of leaves

rhizoids on leaf bases and stem



Open wetland
Pools in swamps

C Common in right habitat

M Must know

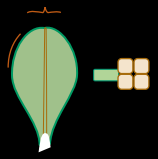
Microscope needed

Large leaves, stems furry almost to the top.

Young plants in a shallow pool in a hemlock swamp. They will be darker and redder when grown.

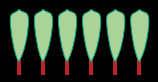
RHIZOMNIUM PUNCTATUM Small plants of rocks and moist logs, strongly bordered leaves, no rhizoids on leaf bases.

A small, common, but not particularly conspicuous species of most rocks, especially in the spray zone of brooks or on dripping ledges. Also occasionally on wet soil or logs. Recognized by the small size, mostly under 1 cm high, broad-oval, strongly bordered leaves, and absence of rhizoids or rhizoidal initials on the leaf bases. It arises from a dense mat and usually has rhizoids on at least the lower stems.



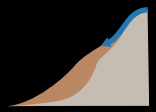
rounded leaves, strong borders, no teeth

small plants, rhizoids in a mat at the base



Groves

Rocks by water



Dirty wet ledges

Seepy shoreline ledges

C

Common in right habitat

M

Must know

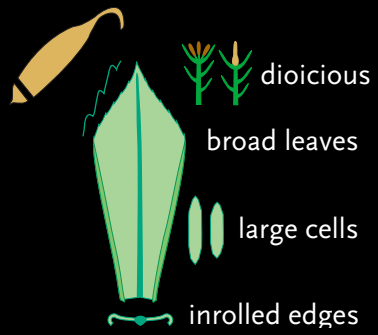
Microscope needed

Strongly bordered leaves, without any teeth; no rhizoids on leaves; the toothed liverwort is probably *Scapania nemorea*.

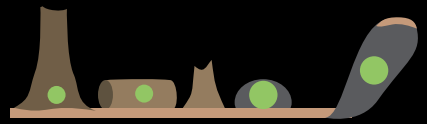
Male plants with antheridia surrounded by perigonial leaves.

RHODOBRYUM ONTARIENSE Large, showy, a single stem with a rosette of oboval leaves at the top.

Large, showy species of fertile soils, forming groves on tree bases, logs, and limy rocks. Immediately recognizable from the size and growth form. Some Bryums are similar, but much smaller.



Treelike



Near the forest floor, in fertile mesic woods and swamps; also on limy rocks

C Common in right habitat

M Must know

Oboval leaves in rosettes, toothed above, with sharp points and weak borders; with *Campylium chrysophyllum*.

Large oboval leaves with sharp points in a rosette at the top of the stem; again with *Campylium chrysophyllum*.

Elongate capsules, often several setae per stem; with *Thuidium sp.* and white cedar shoots.

With *Anomodon attenuatus, Brachythecium* (likely *laetum*), and walking fern.

RHYNCHOSTEGIUM SERRULATUM Small moss of moist forest floors, with flattened shoots and toothed costate leaves with twisted tips.

A shiny flattened moss of deciduous forest floors, growing on soil, rocks and woods. Resembles *Brachythecium* in the slender leaves and weak single costa that ends in a spine. Separated by the combination of toothed edges, twisted tips, and barely differentiated alar cells. Resembles *Plagiothecium* and its relatives in the strongly flattened shoots; no *Plagiothecium* has a costa or is this toothy.

Moist forest floors

Low flat mat

U

Uncommon

Microscope needed

Much like *Brachythecium,* but with twisted tips, strong teeth, and undifferentiated alar cells. Use the microscope!

Flattened, shiny shoots, like *Plagiothecium* but costate.

RHYTIDIADELPHUS Large, shaggy-looking, erect, irregularly branched mosses with rounded-triangular leaves spreading widely from the stem.

triquetrus

C

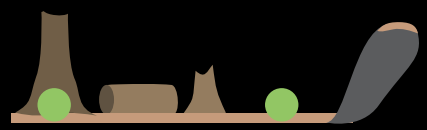
Common in right habitat

squarrosus

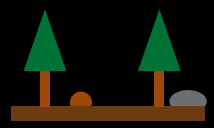
U

Uncommon

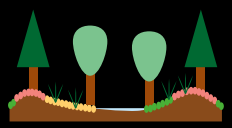
A common and locally dominant species of moist conifer woods and wet openings in deciduous woods, often growing in large stands. Easily recognized: erect growth, divergent branches; broad, wide-spreading, pleated leaves; pipe-cleaner look. A related species, *Rhytidiadelphus squarrosus*, which occurs in wetlands and by streams, is smaller, not pleated, and has squarrose (arching outwards) leaf tips. *Triquetrus* leaves point out but don't arch much.



Mineral soil in forests



Boreal forest



Swamp

Canopy of branches

Pipe cleaners

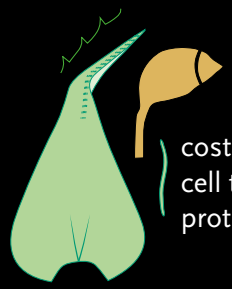
Loose thatch

M

Must know

RHYTIDIADELPHUS SQUARROSUS Leaves rounded triangular, constricted to long, narrow arching tips; costa short and double; cell tips do not protrude.

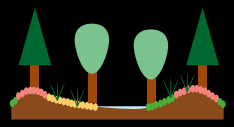
Smaller than *triquetrus*, with longer tips, weaker costas, and smooth cells. Grows in loose tangles in swamps and on rocks in streams. The slender arching tips of the stem leaves are distinctive.



costa weak; cell tips do not protrude

leaves with slender arching tips

Rocks by water



Swamp

Loose thatch

Pipe cleaners

F

Identifiable in field

U

Uncommon

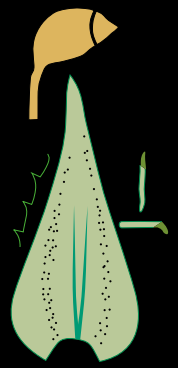
Loosely pinnate; red stems; leaves with long arching tips.

In a loose mat in a minerotrophic swamp, with two Sphagnums, likely *rubellum* and *palustre* or *centrale.*

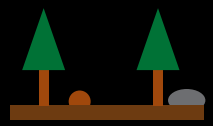
More tangled and less erect than *triquetrus*; red stems, leaves with long arching tips and short costas.

RHYTIDIADELPHUS TRIQUETRUS Large, shaggy, erect, irregularly branched, with pleated leaves spreading widely from the stem.

A large distinctive common moss, found in large patches on the floors of moist conifer forests, and, in smaller amounts, in moist thickets, stream bottoms, and meadows. It can be identified on sight by its erect growth and shaggy look. The pleated leaves with strong costas are a good confirmation.



leaves pleated, with straight tips and strong double costas; cells protrude at tips



Boreal forest

Temperate forest

Pipe cleaners

Canopy of branches

C

Common in right habitat

M

Must know

Red stems, pleated spreading leaves, spreading branches, pipe-cleaner look.

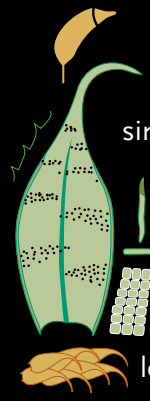
Treelike growth with irregular branching; leaves spreading but not arching.

On the shady edges of a mowed lawn, with *Polytrichum commune* and a little *Pleurozium schreberi*.

Stems growing downwards and forming a thatch on the steep bank of a stream in boreal forest.

RHYTIDIUM RUGOSUM Large, pinnate, golden, thick branched, with curved ripply leaves that point downwards.

A handsome moss of open limy ledges and soils, forming dense mats and cushions on ledge crests and summits. Uncommon overall but locally plentiful on open limy ledges. A characteristic drip-edge species that forms mats where water from soil seeps over bare rock. Recognized by the bright color and ripply falcate-secund leaves. Confirmed by the protruding cells, single costa, and numerous small alar cells. *Hypnum imponens* has similarly curved leaves but is about half the size, not rippled, and lacks a costa.



Calcareous rocks or soil

Arching fronds

Loose thatch

F

Identifiable in field

U

Uncommon

Arching growth form from a cliff edge, with the falcate-secund leaf tips curved downwards; something like a giant *Hypnum* with ripply leaves.

Shiny, ripply leaves, tips turned away from the camera.

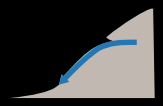
Making shingles on a ledge; golden color, frondose growth, large size.

In coastal tundra, northwest Newfoundland, with *Dryas integrifolia* and *Racomitrium lanuginosum*.

A drip-edge mat catching surface flow at a cliff edge; drip-edge species (*Plagiothecium*, *Polytrichum*, *Pseudocalliergon turgescens* ...) specialize in the transition between vegetation and rock.

SAELANIA GLAUCESCENS Small moss with slender pale-green leaves; leaves and stems with a blue-white, spider-webby coating.

Small, rare, and distinctive, in crevices in rocks or in clumps in rocky barrens, often with calcareous seepage. Leaves pale green, linear, with small square cells and some teeth near the tip; stem and lower leaves covered with blue-white, spider-webby filaments. The filaments are the best field character.



Seepy ledge

Tufts

Small cushions

F

Identifiable in field

R

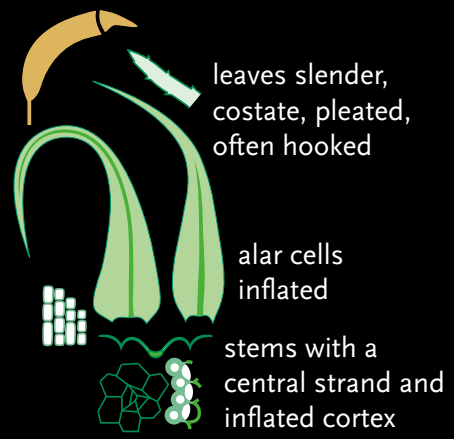
Rare

In small tufts in crevices, or large clumps on scree and ledges; pale linear-lanceolate leaves with patches of blue-white cobwebby stuff; here with clumps of sorediate lichen.

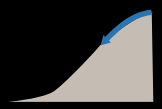
Erect capsules, slender leaves with square cells and patches of blue-white stuff.

SANIONIA UNCINATA Slender, loosely pinnate moss with hooked costate leaves that are pleated when dry.

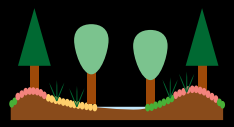
A sickle-leaved wetland moss, related to *Drepanocladus* and *Warnstorfia* and like them with costate leaves and inflated alar cells. Separated from them by the pleated leaves and the inflated stem cortex. Found in a wide range of habitats: swamps, pools, moist ledges, dryer rocks, tree trunks, and logs. Wide ranging and regularly encountered but not common in the areas we work.



Trees



Wet ledge



Swamp

Loose thatch

U

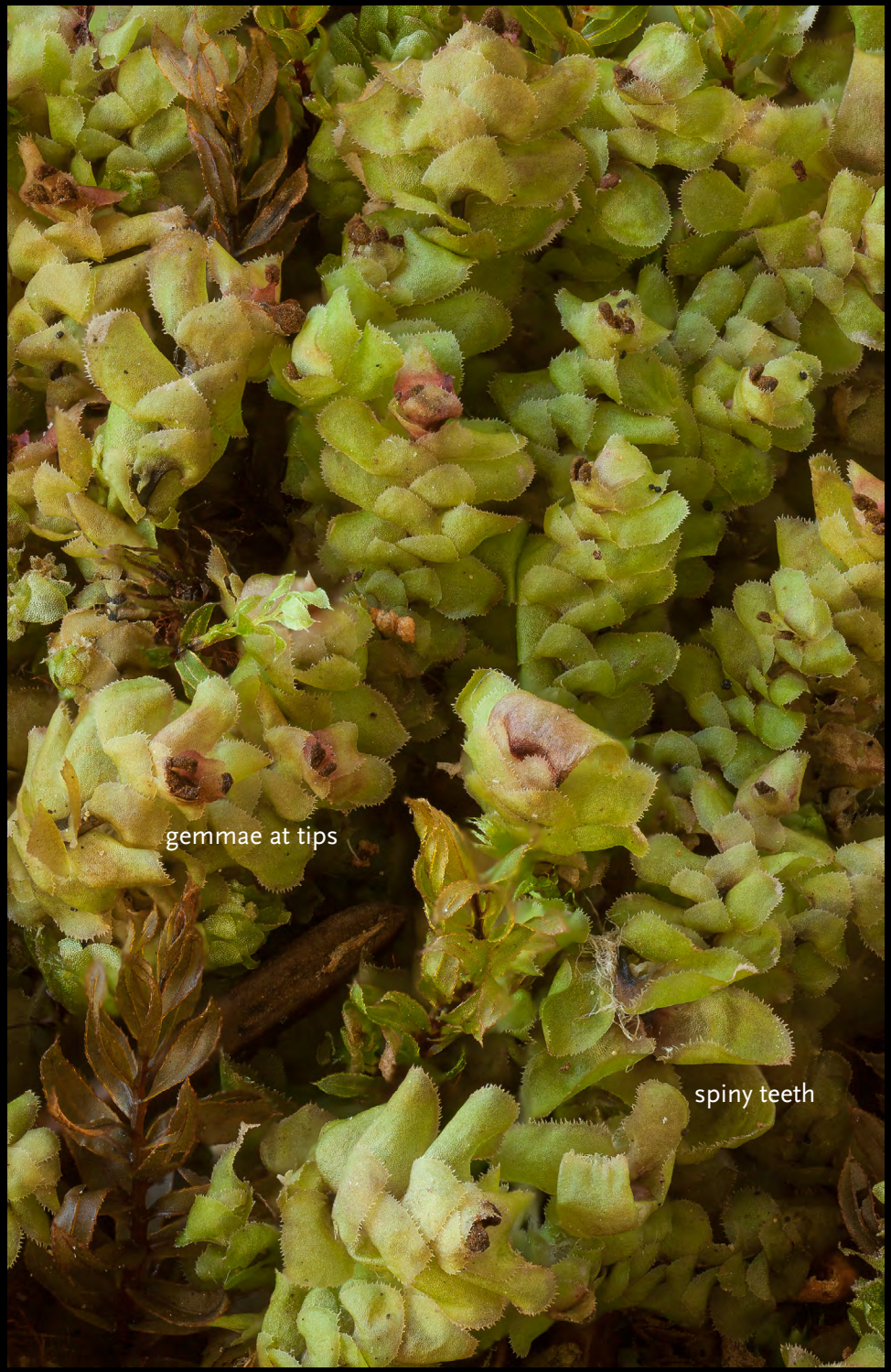
Uncommon

Microscope needed

Loosely pinnate growth; slender costate pleated falcate-secund leaves; light green or golden.

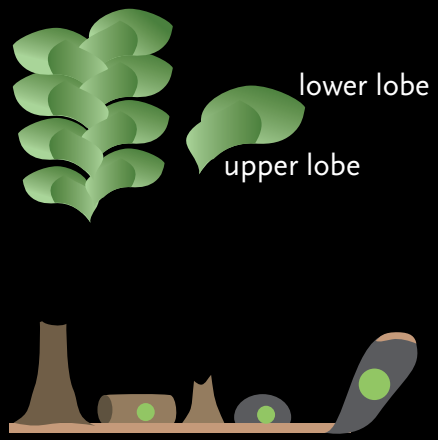
Often in loose mats or tangles.

SCAPANIA NEMOREA Large lower lobe with a smaller upper one folded over it, sharp spiny teeth, both lobes running down stem.



A large, often dominant, liverwort of wet ledges, especially in the splash zone of brooks, also common on submerged rocks in stream channels and, in smaller quantities, on the lowers sides of boulders and logs, especially in wet woods. Each leaf with a small upper lobe folded over a larger lower one, and shingled so that the front edges of the upper lobes are visible from above.

We have several species, of which *nemorea* is by far the most common. It is relatively large, has both the upper and lower lobes decurrent on (running down) the stem, and has strong spiny teeth and reddish, one-celled gemmae. Most of the other species are quite rare.



C Common in right habitat

M Must know

Microscope needed

In a loose mat, with *Mnium hornum* and another liverwort, likely *Calypogeia*.

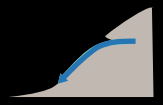
SCHISTIDIUM Dark, narrow-leaved mosses, leaves with at most short needle tips; capsules surrounded by enlarged perichaetial leaves; central column of capsule remains attached to lid.

apocarpum

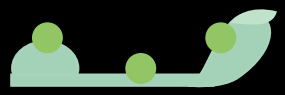
crassithecium

A complex genus, recently subdivided; we follow the traditional concepts here, treating *apocarpum* as a group. Dark mosses, growing in loose patches on wet or dry rocks; leaves lanceolate, often with recurved edges and wavy-edged cells; capsules short and cup shaped, the central column falling with the lid. Close to and formerly a part of *Grimmia*. The looser clumps, immersed capsules, and missing central columns are the best ways of separating them.

Columella attached to capsule lid, capsules surrounded by perichaetial leaves



Seepy ledge



Calcareous rocks or soil

Rocks by water

Low flat mat

Small cushions

maritimum

rivulare

C

Common in right habitat

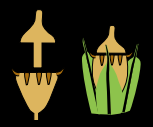
M

Must know

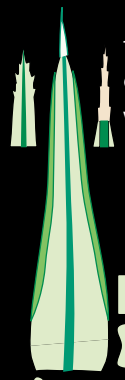
Microscope needed

SCHISTIDIUM APOCARPUM GROUP Lanceolate leaves with recurved edges, sometimes papillose, sometimes toothed; costa ending in the tip or excurrent in a needle tip.

A common group of mosses, found on both acid and limy rocks, often near water, and often where there is at least intermittent seepage. They have short hair points, usually a few teeth, and often have papillae on the lower side of the costa near the tip; fertile plants have oblong capsules, narrower than those of *rivulare*. *Schistidium apocarpum* is common everywhere; other species in the group (*lancifolium, lilliputanum, papillosum, pulchrum*...) are either rare or poorly known.



columella falls with capsule lid

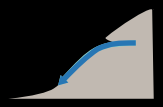


tips often toothed, often with short white hair points

dog-bone cells present

recurved edges

Rocks by water



Seepy ledge

Low flat mat

Small cushions

C

Common in right habitat

Microscope needed

Leaves lanceolate, edges recurved, tips with short white points; capsules surrounded by enlarged perichaetial leaves; columella falls with lid and is absent from open capsules.

Leaves with short white tips, open capsules missing the central column.

In thin mats on intermittently dry rocks, thicker ones in seepage or in the spray zone.

Cushions may resemble *Grimmia* but the needle tips are shorter and the capsules are surrounded by enlarged perichaetial leaves.

SCHISTIDIUM CRASSITHECIUM Small dark plants in dense cushions, usually sterile. Leaves ending in thickened tips, without white points; upper margins thickened, club-like in section.

A recently described species, like *apocarpum* but with thickened tips instead of white hair points, and thickened upper margins. We have seen it on exposed marble ledges in Vermont; it grows in small dark clumps, in association with and sometimes mixed with *Tortella inclinata*; the species is dioicous, and we haven't seen capsules. Like the *Tortella,* it is a surface species that receives flow from a vegetated turf, rather than a crevice-and-seepage species.

Calcareous rocks or soil

Small cushions

R

Rare

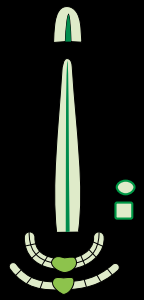
Microscope needed

SCHISTIDIUM CRASSITHECIUM (black mounds) and *TORTELLA INCLINATA* (orange mounds)

On Cambrian marble at Mt. Equinox, Vermont, with harebell, purple-stemmed cliff-brake, and *Tortella inclinata*. The sloping ledge receives surface flow from the turf above it, which is stabilized by *Carex scirpoidea*, creeping juniper, and shrubby cinquefoil.

SCHISTIDIUM MARITIMUM Small, dark, cushion-forming plants of sea-coast rocks; leaves two-layered above, without needle tips.

Uncommon species making small, dark cushions on seacoast boulders. Usually above the range of storm tides but still in the spray zone. Leaves concave, bistratose above, without needle points; costas with two stereid bands.



lanceolate, concave leaves, bistratose above, without needle tips

Small cushions

Rocks by sea

U

Uncommon

Microscope needed

Plants small, in dense cushions; leaves concave, without needle points.

Capsule surrounded by enlarged perichaetial leaves; as in all Schistidiums, the columella (central column of capsule) is missing from open capsules. Note thick blunt tips.

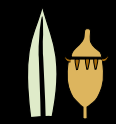
Small plants in dense mats, exposed to wind and ice, sometimes waves.

Leaves slender, without white needle tips.

On granite, along a seepage crack, Great Wass Island, Maine.

SCHISTIDIUM RIVULARE Dark, sharp-tipped, on rocks in streams; leaves keeled, with recurved edges; tips sharp and toothed, but without hair points.

A dark shaggy moss found on rocks in and near streams. Generally like the *apocarpum* group, but the leaves without hair points, the capsules shorter, the costa not papillose, and the cells not particularly wavy-edged. Plants intermediate between the two are not hard to find; *Schistidium* is like that.



capsules short

Pointed leaves without hair points

costa not papilllose

edges recurved

Rocks in streams

Low flat mat

C

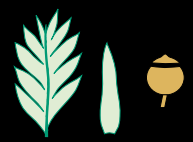
Common in right habitat

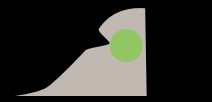
Microscope needed

Lanceolate leaves with recurved edges and sharp points but without hair points; on rocks near streams; hard to separate from forms of *apocarpum* without hair points.

SCHISTOSTEGA PENNATA Tiny, pale, flattened fronds on moist soil in deep recesses in cliffs or under boulders; globular protonemal cells with chloroplast mirrors that reflect incident light back.

A small, uncommon moss that lives in dark recesses in and under rocks and fallen stumps. The protonema has reflective chloroplasts that shine a narrow beam of light back at you. You see it only when your head almost blocks the incident beam. The flattened fronds and pointed leaves are unique. they resemble those of *Fissidens* but do not have pockets or clasp the leaves above them.





Deep recesses in ledges or under boulders

Protonemal mat

Scattered

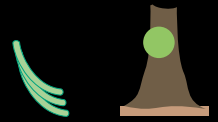
F Identifiable in field

U Uncommon

Pale blue-green, flattened, pointed leaves. This specimen doesn't show the reflective protonema. The skinny-leaved plants are *Ditrichum* or *Dicranella*.

SCHWETSCHKEOPSIS FABRONIA Small stringy moss with loose, light-green, silky branches; leaves long pointed, ecostate; cells diamond-shaped with protruding tips; square cells run up lower edges.

A small southern moss of tree bark and rocks, rare with us. Nondescript in the field: light green, silky-looking, with long-tipped leaves and loose descending branches. Well-marked microscopically: the combination of ecostate, long-tipped leaves and diamond-shaped cells that protrude at their tips is unique.



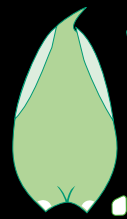
R
Rare

Microscope needed

Stringy, light-green shoots in loose mat; leaves with no points and no costas.

SCORPIDIUM SCORPIOIDES Large, irregularly branched, often wormlike, concave leaves without costas which are curved and secund at the branch tips.

A large, worm-like, cylindrical, irregularly branched, green to black moss growing in wet mats, often in places where you shouldn't step, in northern fens. Leaves concave, with a short double costa or none, curved and secund at the branch tips. Outermost alar cells inflated, usually in a single row, without any transitional cells between and the leaf cells above. *Calliergonella* is similar (concave leaves, weak double costa, inflated alar cells) but is not secund, has more inflated alar cells in more rows, and some transitional square cells between the alar cells and leaf cells above.



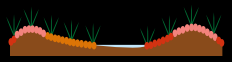
blunt, concave leaves, long cells short costa

small group of inflated alar cells

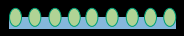
irregularly branched

leaf tips curved to side

stem cortex inflated



Calcareous fen



Loose wet mat

F

Identifiable in field

C

Common in right habitat

Microscope needed

leaves curved to the side at branch tips
cylindrical shoots
leaves curved, pointing away from camera
branching irregular

old stems often brown or black

SELIGERIA CAMPYLOPODA Tiny moss with square cells and undifferentiated alar cells forming dark mats on limy rock; capsules nodding; costa doesn't fill leaf tip.

A patch of *Seligeria campylopoda,* looking like a cyanobacterial mat, mixed with *Gymnostomum aeruginosum* and *Fissidens subbasilaris* (larger and more mossy looking) on a shaded marble cliff.

Seligeria is a genus of tiny mosses restricted to limy rocks. Five species occur in our area. All are rare and hard to find. The plants are only a millimeter or two high and barely noticeable until they fruit. The leaves are slender, the cells are smooth and rectangular, the costas are strong and sometimes excurrent, the alar cells are undifferentiated, and the capsules short and sometimes nodding. All seem to be rare, even in the right habitats. *Camplyopoda*, shown here, has a slender costa that doesn't fill the tip and setae that are curved when wet.

tiny plants with linear leaves

cells square or rectangular, alar cells undifferentiated

short capsules, nodding setae

Calcareous rocks or soil

Thin doormat

R

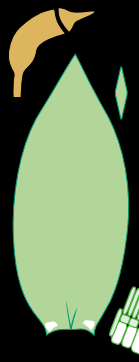
Rare

Microscope needed

Thin mats of *Seligeria, Fissidens,* and *Gymnostomum* near seepage cracks in a marble ledge in Vermont.

SEMATOPHYLLUM MARYLANDICUM Medium-sized golden-green moss on rocks by streams; costa short; alar cells inflated; capsules beaked.

An uncommon moss of rocky streams and waterfalls, recognized by the golden color, concave leaves, and fat branches. Confirmed by the long-beaked capsules, abruptly inflated alar cells, and capsule cells with rounded corners. *Hygrohypnum eugyrium* is very similar and has to be excluded carefully. It has incurved leaf margins, wider shoulders to the leaves, and capsules with shorter beaks. Its leaf tips are often secund. Under the microscope, its stems have a central strand and its capsule cells have sharp corners.



Rocks by water

Low flat mat

U

Uncommon

Microscope needed

Shiny bright-green concave leaves with short tips and costas; lids of capsules with long beaks.

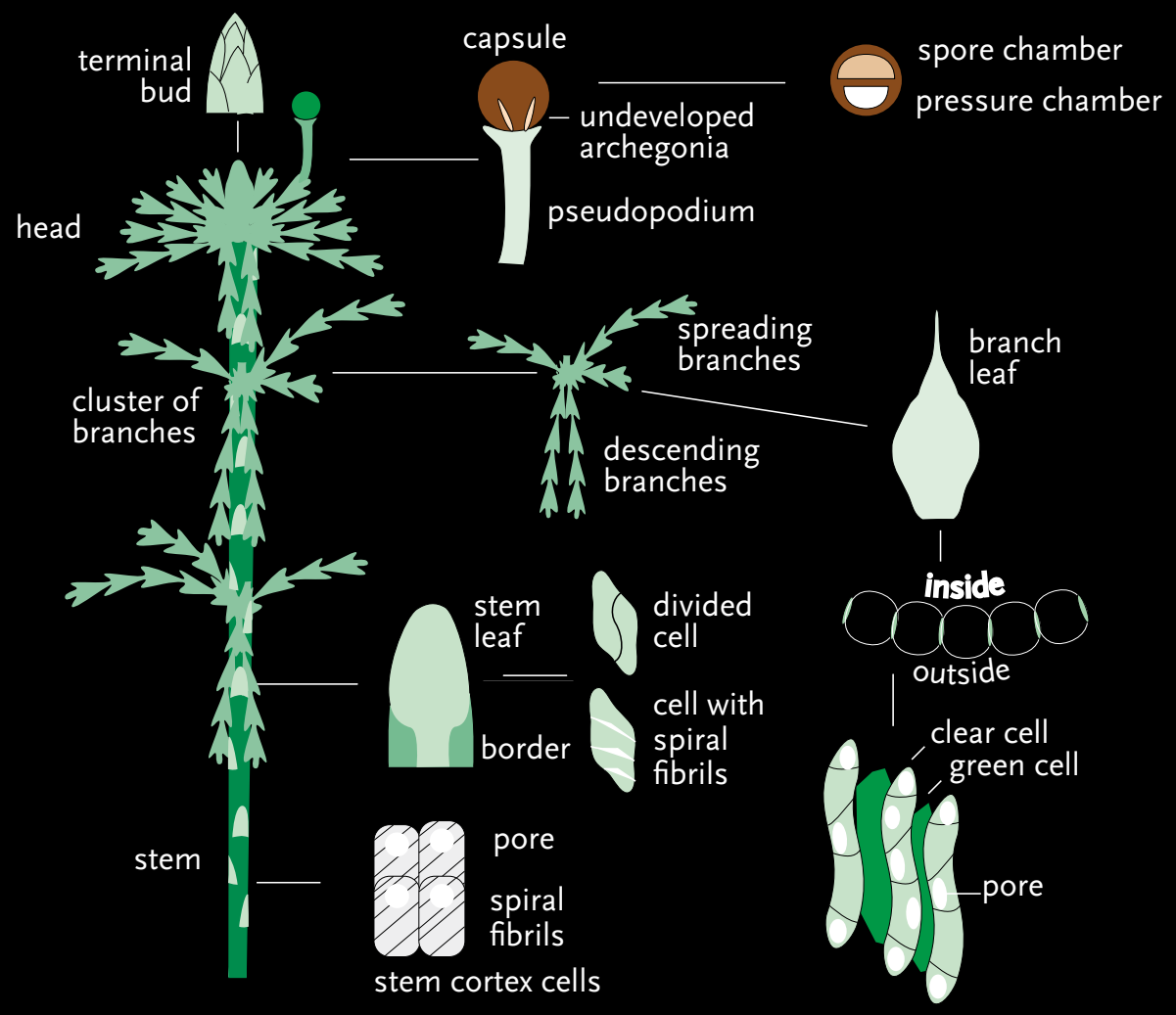
SEMATOPHYLLUM MARYLANDICUM

SPHAGNUM Plants with two sorts of branches, spreading and descending, in groups along an erect stem that has a head of young branches at the tip. Leaves and stem cells with large hollow water-holding cells alternating with small photosynthetic ones.

fallax group

dry branch

SPHAGNUM II: PARTS Sphagnums have a unique architecture: the branches are clustered; the young branches grouped into a head at the top of the stem; the stem and branch leaves are usually different; the leaves alternate clear cells and green cells; and the capsules have no lids, peristomes or setae.



Sphagnum is our largest moss genus and one of the most distinctive. They have erect stems with a head of young branches at the top. The branches arise in clusters. Here each cluster has two that spread and two that run vertically down the stem. The leaves contain large, empty, water-holding cells set in a meshwork of slender green photosynthetic cells. The branch leaves, visible here, are typically concave, slender, and pointed. The stem leaves, hidden under the descending branches, are often broader and longer.

All of these features are useful for identification. The shape of the head, the number of branches in a cluster, and the size and shape of stem and branch leaves can be used in the field. The shapes of the cells require a microscope and often cross-sections. The pores usually require staining.

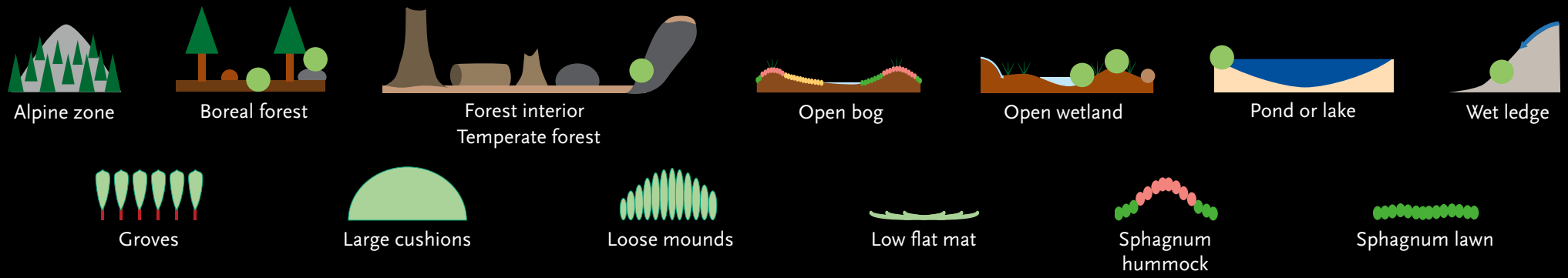
With practice, many species are identifiable in the field. Many others are not. For confirming the easy ones, and making any progress at all with the harder ones, the microscope is essential.

Sphagnum magellanicum

Sphagnum papillosum

Sphagnums are typically plants of wetlands, wet ledges, and cold moist forest floors. They are commonest and most dominant in the boreal north. Many have, however, broad ranges and can be found, in smaller amounts and more restricted habitats, throughout the temperate zone.

Growth forms vary greatly. In sphagnum-dominated bogs and fens, sphagnum forms hummocks and lawns, often covering most of the surface. On cliffs it forms cushions or vertical mats. In swamp and wet forests it may form mounds or cushions, or cover logs and tree bases, or grow as scattered plants.



angermanicum

capillifolium

fimbriatum

fuscum

flavicomans

girgensohnii

rubellum

russowii

subfulvum

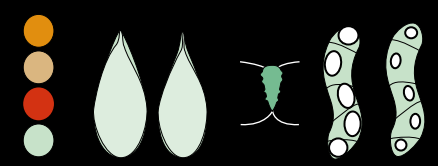
warnstorfii

Small plants, often common or dominant, with slender branches, variously green, red, or brown. Leaves slender oval, neither hooded, long pointed, squarrose, nor wavy when dry. Green cells of leaves exposed on the inner (concave) surface of the leaf. Young descending branches in a single row, never in pairs.

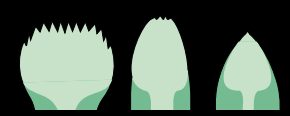
Most similar to the *Cuspidata* and not separable by any single field character. Strong red or brown colors are only found in *Acutifolia;* paired descending branches, long leaf tips, yellows and oranges, aquatic habits, and leaves that are strongly recurved or wavy when dry are only found in *Cuspidata*.

Widely distributed ecologically; all peatlands and most boreal forests contain one or more species of *Acutifolia*.

Often identifiable in the field, at least in typical forms, using color, leaf shape, and leaf arrangement. But often puzzling as well; the red and brown species are close and variable. *Rubellum* and *flavicomans* are slippery at times. *Subfulvum* and *russowii* are not sharply defined; they are plants with particular looks in particular niches, and lack good confirmatory characters.



green cells of branch leaves exposed on the inside (concave side)



stem leaves often large or broad

F

Identifiable in field

Microscope needed

SPHAGNUM Section *ACUTIFOLIA*: *ANGERMANICUM* Pale green or yellowish, with large oval stem leaves; heads weakly five parted; young branches compressed.

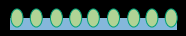
A coastal species of medium fens and wet bogs with some water flowing through. Plants pale green or yellow; stem leaves large. Tips of branch leaves minutely toothed under the microscope. A fairly distinctive species but not strongly marked in the field. The pale color, short thick branches, and somewhat flattened young branches are the best characters.

pale-green, weakly five-parted heads

stem leaves large and oval

young branches somewhat compressed

In bog hollows



Loose wet mat

F

Identifiable in field

U

Uncommon

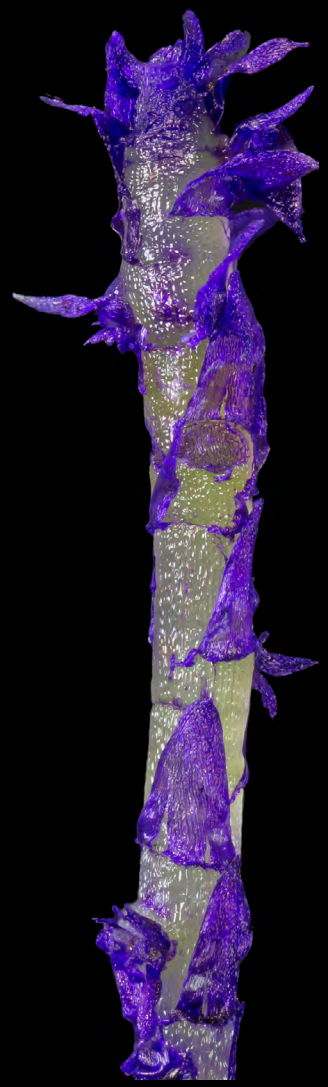
Microscope needed

A pale species with large stem leaves, not very distinctive macroscopically.

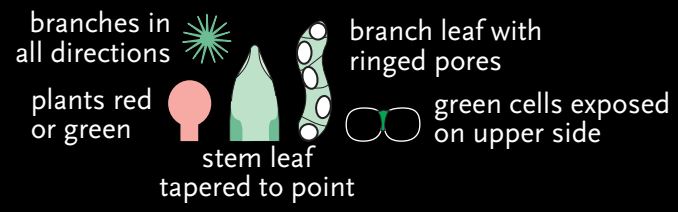
Young branches compressed radially, wider than thick.

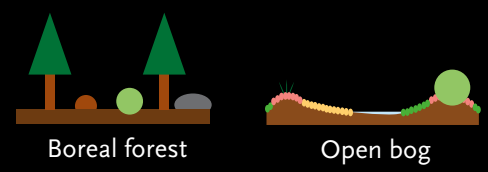
In a wet bog mat in eastern Maine, with *Sphagnum magellanicum*.

SPHAGNUM Section *ACUTIFOLIA*: *CAPILLIFOLIUM* Small plants with round heads, making dense mounds; stem leaves long-triangular and pointed, plants in sun often pink or red, stems often pink or red.



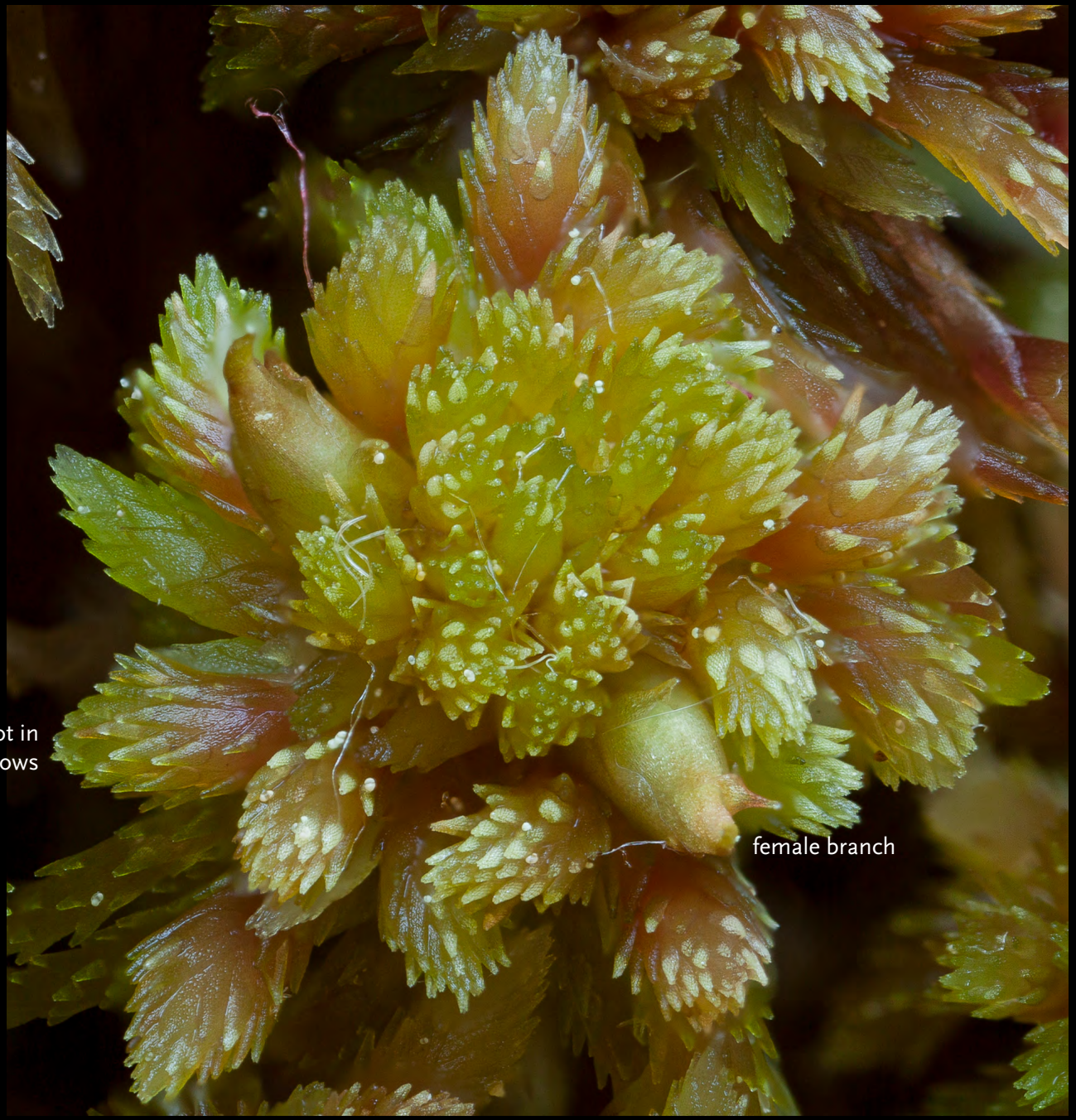
Abundant and characteristic hummock species in wetlands, also common around pools and wet depressions and sometimes at the base of rocks in boreal woods. May be red or green. Field characters are the dense mounds, round heads, spreading branches going in all directions, and elongate and somewhat pointed stem leaves. *Rubellum* is similar but flatter topped, with five-parted heads and sometimes five-ranked branch leaves.





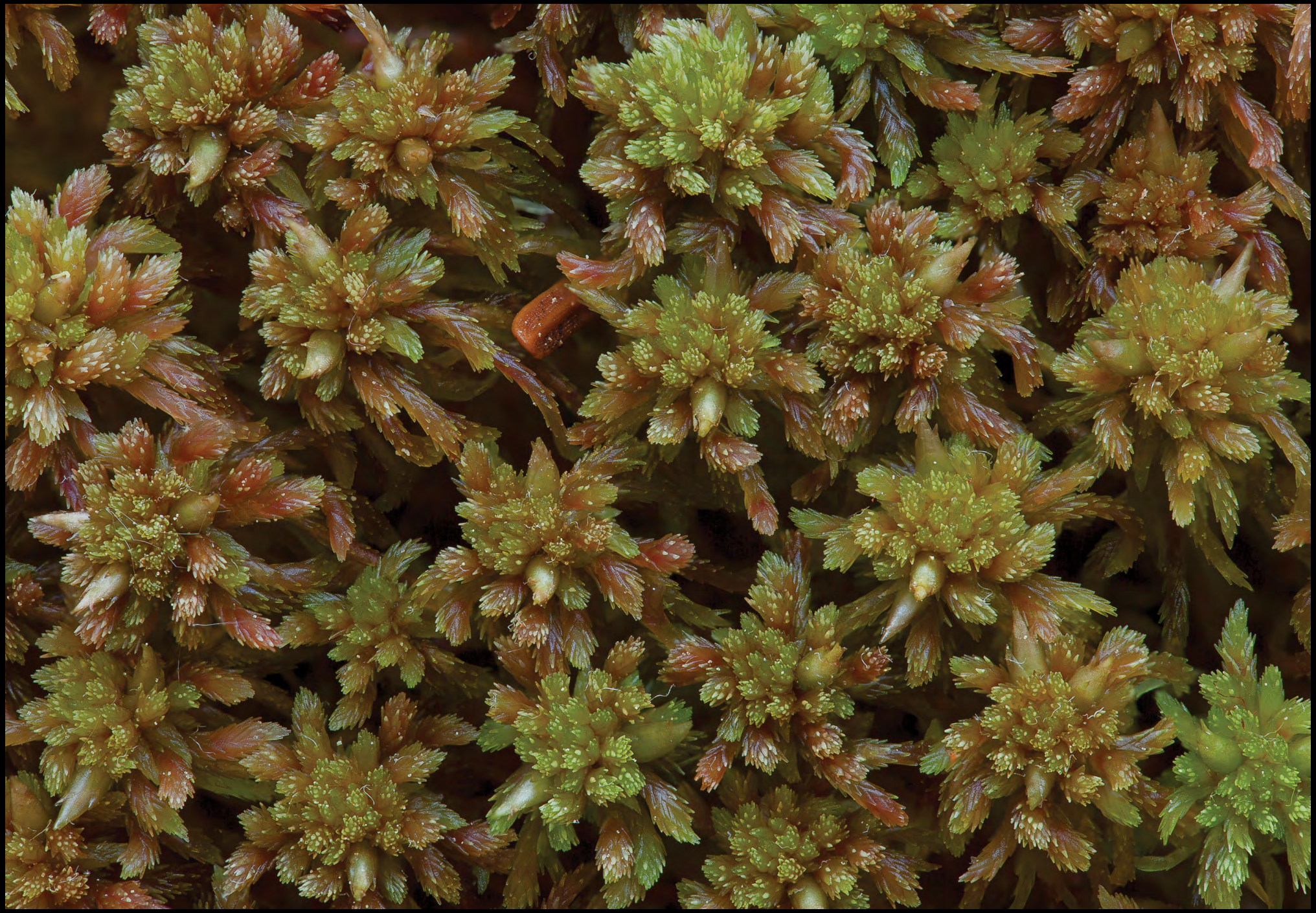
Red color, shaggy look, rounded heads; leaves with slender tips, not in strong rows.

Branch leaves not in rows, heads not strongly five parted.


leaves not in rows
female branch

In an open bog: rounded, tightly packed heads, typically bright red in open.

On the floor of moist boreal forest; plants green, spaced out, with small traces of pink.



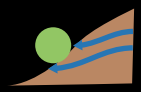
Transitional plants, part red and part green, in a shaded wetland.

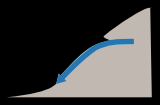
SPHAGNUM Section *ACUTIFOLIA*: *FIMBRIATUM* Slender elongate branches; stem leaves broadest above base, fringed across their top, cupping the stem, and making a conspicuous terminal bud.

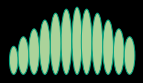
A frequent or common species of moist shores, seepy banks and ledges, and the wet edges of floating bog mats. Usually pale green, with long slender branches; leaves not five-ranked; stem leaves broad, fringed on the top and sides, and making a collar that sheaths the stem. *S. girgensohnii* also has large sheathing stem leaves, but its stem leaves are narrower and only fringed in the middle.

Wet bog mat

Pond or lake


Seepy bank


Seepy ledge


Loose mounds

Common in right habitat

Must know

Microscope needed

Light green, with long slender branches, leaves with slender inrolled tips.

Heads irregularly five parted, loose, with a terminal bud that sticks up.

Often fertile.

As in all Sphagnums, there are no setae, lids, calyptras, or peristomes. The capsules shrink, and the pressure inside blows the tops off.

In loose wet mats in seepage or next to water.

On granite, in seepage crack on the shore of Great Wass Island, Maine; with *Schistidium maritimum* on the vertical face above and *Dicranum flagellare* forming an apron to intercept seepage.

SPHAGNUM Section *ACUTIFOLIA*: *FLAVICOMANS* A medium-sized, orange or brown, hummock-forming species, larger than *S. fuscum*; stem leaves over 1.5 mm long, inrolled to pointed tips.

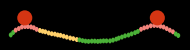
Our pictures of the brown sphagnums are brightly lit to show details; the plants are much darker under natural light.

A large, hummock-forming species, common on the Atlantic coast. Plants dark, resembling *S. fuscum* and often mixed with it, separated in the field by their larger, rounder, looser and more orange-brown heads. Separated in the lab, in theory, by the broader branch leaves and the longer and more tapered and inrolled stem leaves. Sometimes this works.

orange-brown, with dark stems and rounded or five-parted heads

stem leaves inrolled to a pointed tip

Sphagnum hummock



Hummocks in coastal bogs

C

Common in right habitat

M

Must know

Microscope needed

Heads rounded, fat even; branch leaves broadly oval, with short tips.

Heads weakly five parted or irregular; branch leaves not in strong rows; terminal buds inconspicuous.

In a bog on the Maine coast, with *S. fuscum* (dark brown), and *S. rubellum* (dark red).

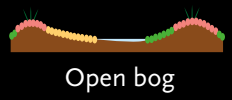
SPHAGNUM Section *ACUTIFOLIA*: *FUSCUM* Small, dark-brown plants making dense mats on the tops and sides of hummocks in bogs; stems dark brown; stem leaves oblong, not inrolled to their tips.

Plants much darker in nature than in photos.

Common on bog hummocks, usually growing higher than any other *Sphagnum*; can cover large areas in dry bogs. The dark color and small, densely packed heads are good characters. In coastal bogs, often mixed with *S. flavicomans*, which typically has larger heads, larger and more inrolled stem leaves and is more orange-brown. The two are close and don't separate cleanly.

heads deep brown, rounder or five parted, stems nearly black

stem-leaves long, parallel-sided, not inrolled



Open bog

Sphagnum hummock

Large cushions

C

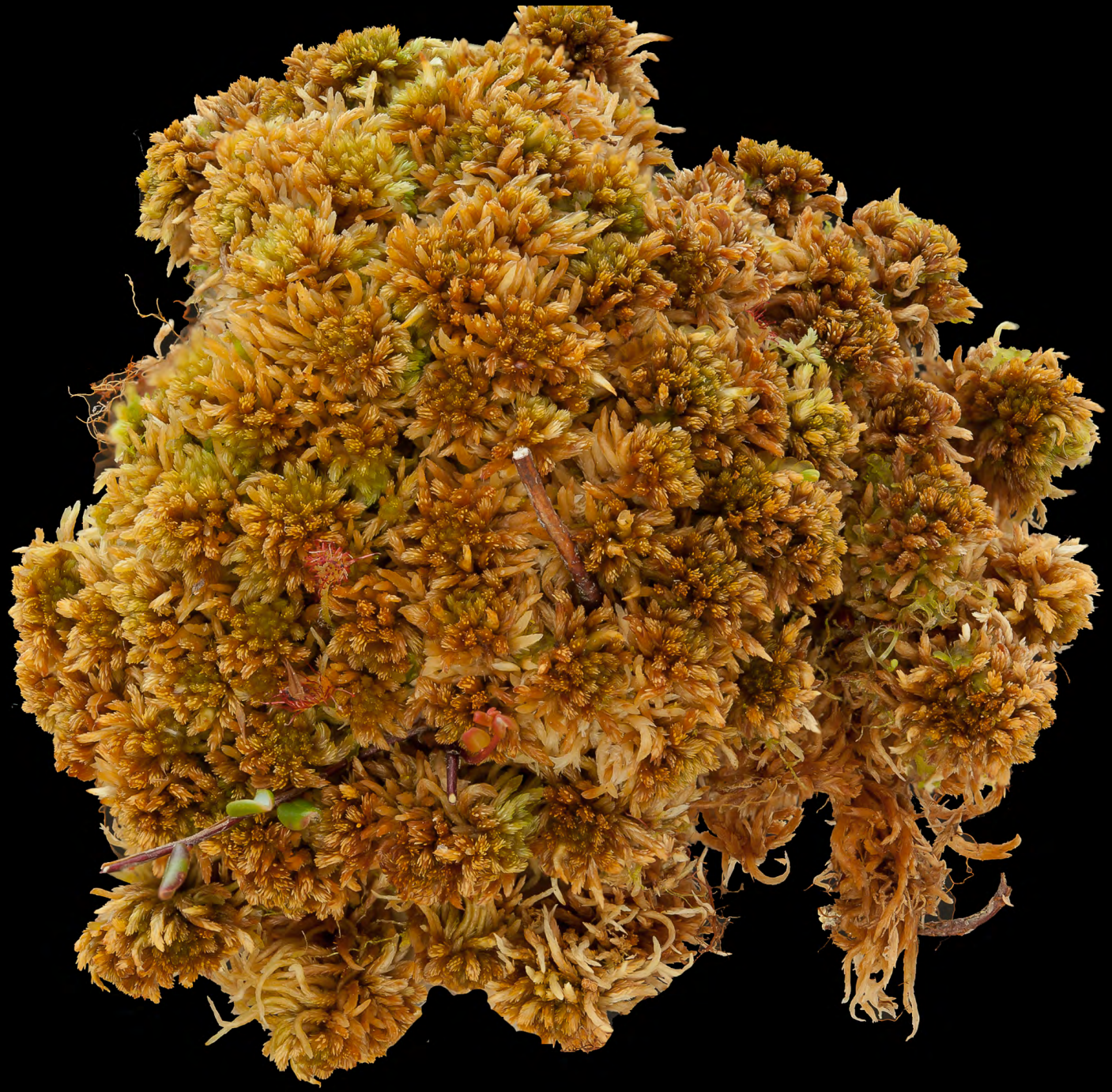
Common in right habitat

M

Must know

Stems dark brown; leaf and branch arrangement vary; terminal bud inconspicuous.

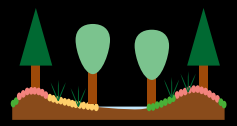
Small plants, weakly five-parted or not, in dense mats.



Small heads, not strongly convex, closely packed together in dense mounds.

SPHAGNUM Section *ACUTIFOLIA*: *GIRGENSOHNII* Always green; five-parted heads with the branches in five directions; young descending branches in a single (zigzag) vertical row; large oblong stem leaves with fringed tops.

The commonest sphagnum of wet conifer forests and spruce-fir swamps, making extensive loose carpets in hollows. Recognized by the five-parted heads with branches radiating in five directions, the large stem leaves fringed across the top, and the young descending branches in a single row. The *fallax* group looks similar and often grows in the same places. It has small triangular stem leaves and paired young descending branches.


Swamp

Boggy pool

Sphagnum lawn

C
Common in right habitat

M
Must know

branches radiate
in five directions
leaves not in five rows

Heads flat-topped or slightly rounded; stems green; young descending branches (circled) in a single vertical row.

On the floor of a confer swamp; stiff (not wavy) branches radiating in five directions. Similar to the *recurvum* group: check for the single row of descending branches and fringed stem leaves to be sure. The plants with the rounder heads mixed in are likely a shade form of *capillifolium*.

Dry plant, with five-parted heads, slender stiff branches, leaves not strongly recurved. Quite similar superficially to the *recurvum* group in the *Cuspidata*, but with descending branches in a single row and large fringed stem leaves.

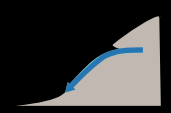
SPHAGNUM Section *ACUTIFOLIA*: *QUINQUEFARIUM* Small green plants with dense round heads; some branch clusters with five or more branches; stem leaves small and pointed.

A northern species commonest in the mountains and near the coast but nowhere abundant. Plants small, with dense round heads, resembling the shade forms of *capillifolium*. The branches have weakly five-ranked leaves, and at least some of the branch clusters have three spreading branches. Typically found on shaded cliffs, often with seepage. Also on dirty boulders and the forest floor.

heads dense and round

branches in clusters of five or more, with three spreading branches in each cluster

stem leaves small, pointed



Seepy ledge

Small cushions

F

Identifiable in field

U

Uncommon

Heads dense, branches skinny and stringy; some branch clusters with five or more branches.

Dense round heads; leaves weakly arranged in five rows.

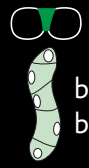
SPHAGNUM Section *ACUTIFOLIA*: *RUBELLUM* Deep red or pink, flat-topped, with five-parted heads and branch leaves more or less in 5 rows.

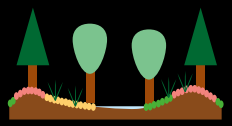
The commonest red sphagnum in wet bogs, forming extensive deep red lawns and low hummocks. Close to *S. capillifolium* and formerly treated as a variety of it. The main points of difference are that it tends to be flat-topped, have five-parted heads and five-ranked branch leaves, and, on the good days, flatter, less pointed, and less fibrillose stem leaves. The differences are neither large nor consistent: the best you can say is that it is very common and, in its most extreme forms, looks different from *capillifolium* and grows in wetter places. Also grows in fens, with *Sphagnum warnstorfii*, and sometimes looking much like it; and on hummocks in forests with *Sphagnum capillifolium*, and sometimes looking much like it. Watch out for red Sphagnums.

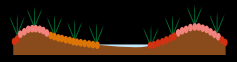
flat-topped five-parted heads

branch leaves weakly 5 ranked

oblong stem leaves with rounded tips


branch leaves with small, bordered pores


Swamp


Calcareous fen

Open bog

Sphagnum lawn

Sphagnum hummock

Locally dominant

Must know

Microscope needed

Deep red when wet, pink when dry, mottled green and red in shade; heads more-or-less flat-topped.

Leaves often in five rows, not flattened or recurved when dry.

In loose mounds and wet mats, often blood-red in sun.

Spring Pond Bog, Adirondacks; the red color in the wet hollows around the pond is *rubellum*.

A wet mat of *rubellum*, with leatherleaf, dwarf cranberry, pitcher plant, and the sedge *Eriophorum vaginatum*.

SPHAGNUM Section *ACUTIFOLIA*: *RUSSOWII* Mottled red and green, with five-parted heads, oblong stem leaves that may be rough or torn at their tips, unranked branch leaves and, when it pleases, outer stem cells with a few pores.

A weakly characterized species, found on pond shores or the edges of wet mats, and often mottled red and green. Close to *rubellum,* from which it is supposed to differ in the unranked branch leaves, stem leaves with teeth or lacerations at their tips, and outer stem cells with a few pores. Possibly less a species than a group of transitional forms. We often see plants that look like *russowii* in the field but lack the microscopic characters it is supposed to have. Sphagnums are like that.

plants red or mottled red and green

heads five parted; branch leaves not strongly ranked

stem leaves with a rounded tip with a ragged center

some outer stem cells with pores

Wet bog mat

Boggy pool

Stream banks

Sphagnum hummock

Sphagnum lawn

Common in right habitat

Microscope needed

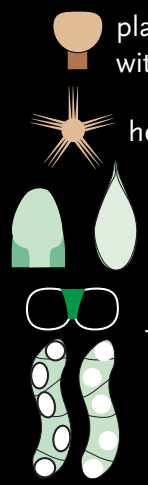
Leaves and stems variegated red and green; heads five parted; branch leaves not in rows.

Female plants with capsules. *Russowii* is said to be dioicous except when it isn't. The plants toward the top with deep red branch tips may be males with antheridial branches.

Possible male plants with red antheridial branches.

SPHAGNUM Section *ACUTIFOLIA*: *SUBFULVUM* Green or pale brown plants with dark stems, five-parted heads, and oblong stem leaves narrowing to a concave apex.

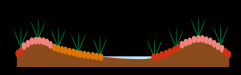
In our conception *subfulvum* is a poorly demarcated species that is found regularly in rich fens, lacks decisive macro or micro characters, and is close to *fuscum* and *flavicomans*. In this sense it includes brown-green plants on hummocks in fens with flat-topped, five-parted heads, a dark stem, and stem leaves rounded at their tips. The branch leaves typically have fairly short tips and are not in five rows; the stems or branch may have a bit of red color. We don't have any definitive microscope characters; when a plant looks too much like a shade form of, say, *fuscum*, we pretend we never saw it. All other authors recognize *subfulvum* as a brown fen plant; no two agree on exactly what it is.



plants brown to green, with a dark stem

heads five parted

stem leaves more concave and tapering more to their tips than *fuscum*.



Calcareous fen

Sphagnum hummock

R

Rare

Microscope needed

Green-brown plants with brown stems; heads five parted; branch leaves not in strong rows; stem leaves oblong, somewhat narrowed to a concave apex.

SPHAGNUM Section *ACUTIFOLIA*: *WARNSTORFII* Red-purple or green or both; heads five parted; short oblong stem leaves with rounded tips; branch leaves sharply ranked, with tiny ringed pores on the outer surfaces of the upper cells.

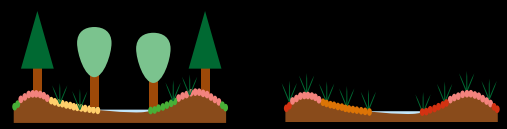
A striking red-purple species of mineral-rich fens and swamps. Plants variously red, green, or mottled, glossy when dry, usually flat-topped and five-parted, with strongly ranked leaves, forming lawns on the lower parts of hummocks. Separated, not entirely reliably, from *rubellum*, by having tiny, round, strongly bordered pores on the outer surface of the upper cells of the branch leaves. *Rubellum* has slightly larger elliptical pores. Since *warnstorfii* has elliptical pores lower down on the leaves and *rubellum* can have a few tiny round ones, this is not as big a deal, or as clear cut, as it sounds.

red-purple flat-topped five-parted heads

branch leaves strongly 5 ranked, recurved when dry

stem leaves with rounded tips

branch leaf pores tiny



Swamp

Calcareous fen

Sphagnum lawn

Sphagnum hummock

F Identifiable in field

C Common in right habitat

Microscope needed

Mottled colors, often with purple or intense red; five-parted heads; strongly ranked branch leaves.

Dry plants with divergent leaves, which may be recurved.

Forming a wet mat in a rich fen in Vermont; the yellow-brown sphagnum has chipmunk teeth and is in the *recurvum* group; a few shoots of *Aulacomnium palustre* near the center.

Shade plants, mottled red and green or green with small amounts of red, in a fertile conifer swamp in New York.

SPHAGNUM SECTION CUSPIDATA Green, yellow, orange, brown and black Sphagnums with small pores, rounded-triangular stem leaves, and slender branch leaves with trapezoidal green cells widest on the outside of the leaf.

cuspidatum

C

Common in right habitat

majus

D

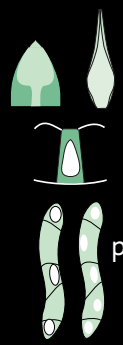
Locally dominant

pulchrum

D

Locally dominant

Common mosses of bogs, fens, and forests, always in loose wet mats. Green, light brown, or orange but never deep red or brown. Recognized microscopically by the combination of small pores, short stem leaves, and green cells exposed broadly on the outer surface of the branch leaves. Identifiable species-by-species in the field, and, when desperate, by the absence of characters that distinguish other groups; there are, however, no macroscopic characters for the whole group.



small stem leaves

green cells widest on convex surface

pores mostly small

recurvum group

D

Locally dominant

tenellum

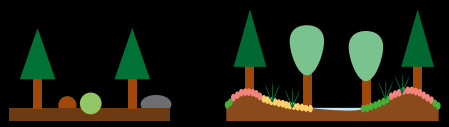
C

Common in right habitat

torreyanum

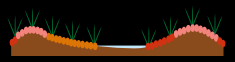
U

Uncommon

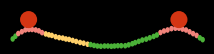


Boreal forest

Swamp



Calcareous fen



On bog hummocks

In bog hollows

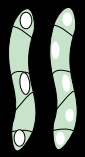
SPHAGNUM Section *CUSPIDATA*: *CUSPIDATUM* Limp, semi-aquatic, light yellow-green plants with long leaves, 5-parted heads, and pointed stem leaves under 1.5 mm long; green cells trapezoidal in section, squared off on the inner surface.

Cuspidatum is a common species of bogs and fens, found floating in pools or sprawled on the mud when the pools dry. Its marks are its light color, long inrolled leaves, and limpness. The short, pointed stem leaves and cells with few pores are good lab characters.

pale green or yellow

leaves long and inrolled to needle tips; stem leaves pointed

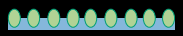
green cells trapezoidal



few pores, mostly at cell ends

Pond in bog

In bog hollows



Loose wet mat

C

Common in right habitat

M

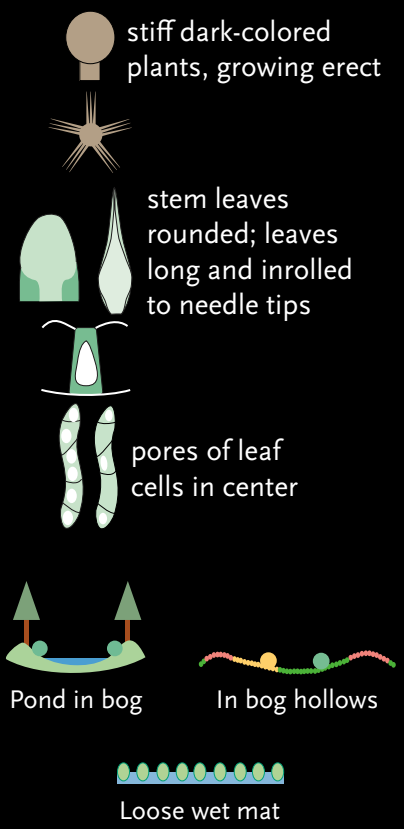
Must know

Plants floating or sprawling, limp, yellow-green; leaves long, slender, inrolled, recurved when dry.

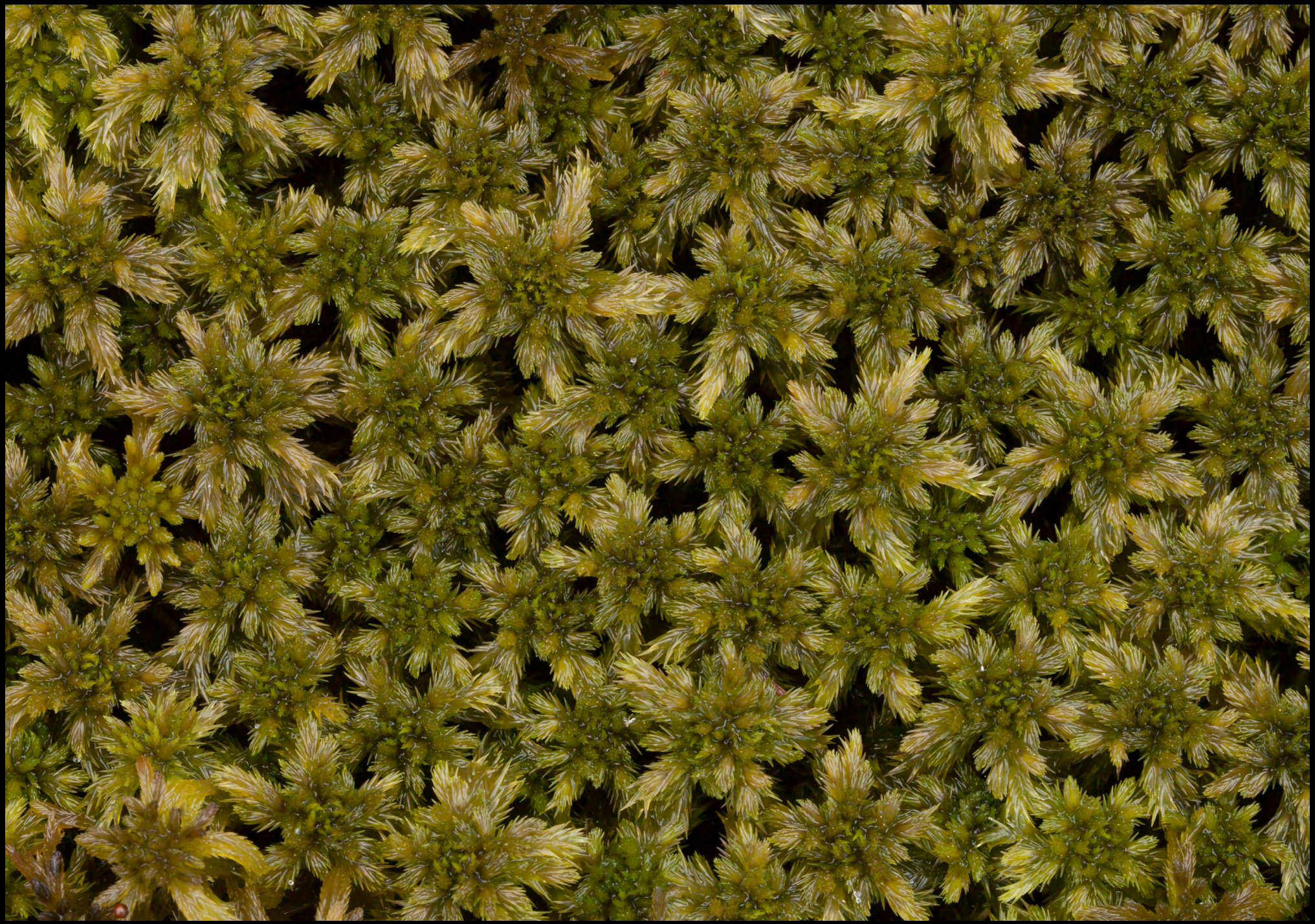
Leaves recurved and divergent dry, all stuck together like a wet paintbrush when moist.

SPHAGNUM Section *CUSPIDATA*: *MAJUS* Long-leaved like *cuspidatum*, but darker and stiffer, growing erect; stem leaves rounded, pores of branch leaves larger, in the centers of the clear cell.

A common, semiaquatic species making lawns in wet bogs and fens, or floating or submerged in boggy pools. The long leaves resemble those of *S. cuspidatum* and *S. torreyanum,* and it grows in similar habitats. In the field it tends to be smaller and less feathery looking than *torreyanum* and stiffer and darker than *cuspidatum*. In the lab, it has rounded stem leaves and more pores on the outer surface of the branch leaves than either of these.



Long, needle-pointed leaves, recurved and spiny when dry.



Dark, five-parted, long leaves; often in low loose wet mats.

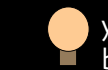
A low, wet mat, with dark *majus* mixed with lighter *fallax* or *angustifolium*, the sedge *Dulichium arundinaceum*, and bog bean.

Dark green, somewhat spiny looking, in a wet mat with bog bean.

SPHAGNUM Section *CUSPIDATA*: *PULCHRUM* Orange to brown, with five-parted heads and strongly ranked, oval leaves; green cells don't reach the inner surfaces of the branch leaves.

A common species of coastal sphagnum bogs and fens, forming extensive lawns, distinguished by the combination of yellow-brown color, five-parted heads with strongly ranked branch leaves, young descending branches not in pairs, and oval branch leaves with relatively short points. Under the microscope, the triangular green cells, exposed only on the outer surface, are distinctive.

The *recurvum* group has paired descending branches, the *cuspidata-majus-torreyanum* group has longer leaves. Neither is usually this bright in color nor as strongly ranked.



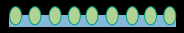
yellow-brown or orange-brown five-parted heads

branch leaves strongly five ranked

green cells don't reach inner surface of leaf

Sphagnum lawn

In bog hollows



Loose wet mat

D

Locally dominant

M

Must know

Orange-brown color, strongly ranked leaves which give the branches sawtooth edges.

Orange-brown color, sawtooth edges, in low wet mats.

A green form; these are likely male plants with short antheridial branches.

SPHAGNUM Section *CUSPIDATA*: *RECURVUM* GROUP Five-parted heads with the branches in five directions, small, triangular stem leaves that often point downward, young descending branches in pairs.

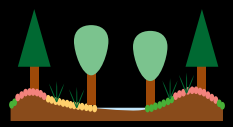
angustifolium

Three closely related forms, *angustifolium, fallax*, and *recurvum,* that form loose carpets in open and shaded wetlands. They were formerly varieties of a broadly defined *recurvum* and are now usually treated as species, though usually with disclaimers in fine print. *Angustifolium* and *fallax,* the two common forms, overlap morphologically and ecologically, and we group them together here.

The best features for the group are the five-parted heads, the small stem leaves which often point downwards on the stem, the pairs of young descending branches (chipmunk teeth), and small unringed pores on the branch leaf cells. *Sphagnum girgensohnii* looks like the *fallax* group and can grow mixed with them, but has a broad stem leaf that is fringed across the apex and a single row of branch buds.

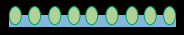
The two common species are separated by size and leaves. *Angustifolium* is relatively small, with tiny stem leaves under 0.8 mm long with rounded tips and slightly recurved branch leaves; *fallax* is larger, has larger stem leaves with pointed tips, and strongly recurved branch leaves.

heads five parted, young descending branches in pairs; stem leaves often point down


Swamp

In bog hollows

Sphagnum lawn


Loose wet mat

Locally dominant

Must know

Microscope needed

Angustifolium is green or yellow, fairly small, and, conventionally, has small stem leaves with rounded tips, and often has some pink on the stems or branches. *Fallax,* again conventionally, is larger, browner, and has pointed stem leaves and branch leaves that are strongly recurved when dry. In our experience, the two often grow together, and the differences are not clearly expressed. We illustrate some typical plants of each here, with the warning that there are plenty of nontypical plants out there.

Green, yellow, or orange; five-parted heads; branch leaves with slender tips; paired descending branches.

Dry leaves unroll, flatten out, and recurve at their tips, looking wider than the wet leaves.

Colors generally pale; often some faint pink on leaves or stems.

In a rich fen in Vermont; yellow-brown, in loose wet mats; *fallax* could be here as well; there is no good way to tell without looking at stem leaves.

In a wet hollow in a minerotrophic swamp in Massachusetts; plants green, in loose mats; stiff branches, five-parted heads; spreading branches dry faster than heads. *Girgensohnii* grows in the same places and looks similar; check for the chipmunk teeth of fallax and the large stem leaves of *girgensohnii*.

Fallax, like *angustifolium* and *recurvum,* has five-parted heads, young descending branches in pairs, branch leaves that are recurved when dry, and triangular stem leaves that often point downwards. It differs from *angustifolium*, weakly, in its more recurved leaves and larger and more pointed stem leaves.

Small plants of *fallax* are stiff branched and slender and very similar to *angustifolium*, especially when wet. You can make a call based on the length and sharpness of the stem leaves, but it seems pretty arbitrary.

Larger plants of *fallax* can have long soft branches and leaves that flatten and recurve when dry. They are striking, but not sharply separable from the smaller forms. Red stems and branches are not supposed to occur in *fallax*, or, for that matter, Section *Cuspidata*, but they do.

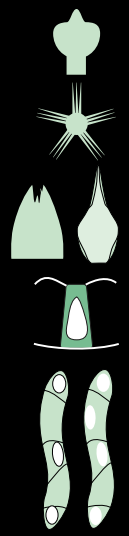
Large forms with long, drooping red branches and divergent leaves.

If all *fallax* looked like this it would be a distinct species. But it doesn't, and isn't.

Sphagnum fallax on the floor of a conifer swamp coastal Maine. This form, with stiff branches and dry leaves not strongly recurved, is close to *angustifolium*.

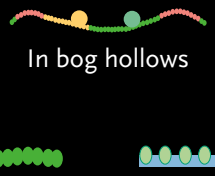
SPHAGNUM Section *CUSPIDATA*: *RIPARIUM* Heads five parted, with a large central bud; stem leaves with a tear down the center.

A common species in the subarctic, rare with us. Associated with wet, somewhat minerotrophic fens and pools in bogs. Resembles the *recurvum* group and, like them, grows in hollows and lawns near the water table. Recognized in the field by the pale color, five-parted heads, large terminal bud, and, with a good lens, the split down the middle of the stem leaves.



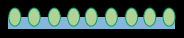
heads five parted, with a large central bud

stem leaf with ragged edges and a ragged notch in the middle



In bog hollows

Sphagnum lawn



Loose wet mat

F

Identifiable in field

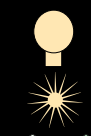
R

Rare

Microscope needed

SPHAGNUM Section *CUSPIDATA*: *TENELLUM* Small soft plants with the stem and branch leaves both oval; green cells broadly triangular.

A small semiaquatic species of bog pools, common in wet bogs and fens in the north and near the coast. Light green or brown, soft or limp, often submerged. Recognized by the oval stem leaves, similar in size and shape to the branch leaves. Confirmed by the small, broadly triangular green cells and tall bulging clear cells.



pale green or tan, semiaquatic, soft and limp

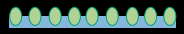
stem and branch leaves both long oval

green cells broadly triangular

Pond in bog

In bog hollows

Wet bog mat



Loose wet mat

C

Common in right habitat

M

Must know

Pale, soft, oval, semiaquatic; stem and branch leaves both oval with short points.

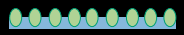
SPHAGNUM Section *CUSPIDATA*: *TORREYANUM* Large, dark, stiff, long-leaved, spiny or feathery, and aquatic; green cells triangular, barely or not reaching the inner surface of the leaf.

A large, long-leaved species, often dark green or black and looking feathery or spiny, growing in wet mats or floating in pools. It is mostly found near the coast. *Majus* and *cuspidata* are similar. *Majus* is usually smaller and has numerous pores on the outer surfaces of the branch leaf cells. *Cuspidata* is limp when submerged, doesn't look feathery or bristly, and has trapezoidal green cells that are exposed on the inner surface of the branch leaves.

Boggy pool

Wet bog mat

In bog hollows



Loose wet mat

F Identifiable in field

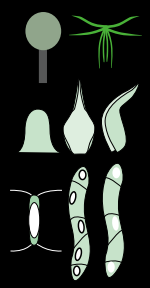
U Uncommon

Big dark, shaggy or feathery plants, in low wet mats or floating in pools. Leaves with long, inrolled tips.

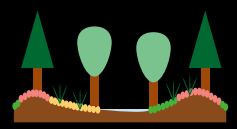
Leaves unrolling when dry, becoming broad and recurved.

SPHAGNUM Section *POLYCLADA*: *WULFIANUM* Plants big-headed and free-standing, on hummocks in conifer swamps, looking like palm trees or lollypops; 6 or more branches per cluster.

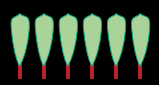
A shaggy big-headed species of fertile conifer swamps, most commonly under white cedar. The driest and least colonial of our Sphagnums, often growing as scattered plants, sometimes in loose mounds, sometimes in carpets. The lollypop heads and brown stems with six or more branches per cluster are diagnostic. The branch leaves are strongly recurved when dry.



large, mop-headed, branches in clusters of six or more



Swamp



Groves

Scattered

F Identifiable in field

U Uncommon

Branches in clusters of six or more, with three or more spreading branches; leaves recurved when dry.

Plants stiff, free standing, with big round heads; leaves with slender spreading tips.

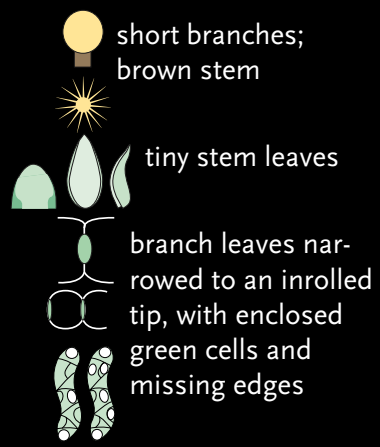
Round heads, leaves with slender spreading tips.

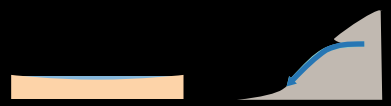
On the floor of a white-cedar swamp, with *Hylocomium splendens*.

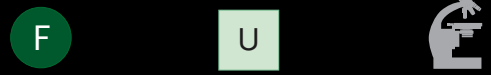
Forming a carpet, in a white-cedar swamp in Vermont. *Carex vaginata,* rare in Vermont, in front of the tree.

SPHAGNUM Section *RIGIDA: SPHAGNUM COMPACTUM* Dense mats or mounds on mineral soil; elongate, concave oval leaves with resorbed edges, narrowed to narrow inrolled tips; tiny stem leaves; green cells enclosed by clear cells.

A distinctive species, usually pale or dirty green and growing in dense flat mats on rocks with seepage or wet mineral soil. The plants are typically packed closely together, making it hard to distinguish heads and branches. The concave branch leaves that narrow to a squared off, inrolled tip are a good field character. Confirmatory characters are the small triangular stem leaves, the resorbed (partially dissolved) edges of the branch leaves, the completely enclosed green cells, and the pores in groups of three on the inner surfaces of the branch leaves where the points of the clear cells come together.







Identifiable in field

Uncommon

Microscope needed

Distinctive gravy-boat leaves: oval and deeply concave at the base, narrowed to an inrolled point with a few teeth at the tip.

Wide-spreading leaves, concave at their bases, narrowed to inrolled tips. Compare *Sphagnum squarrosum,* in which the tips are broader and abruptly bent outwards.

Leaves with long inrolled tips, open and toothed at the ends.

A compact growth form, in seepage on an open ledge; the heads are close packed and hard to distinguish. With *Polytrichum juniperinum*.

A loose, shingled growth form, on the side of a shaded cliff with seepage.

SPHAGNUM Section *SPHAGNUM* Branches thick and often short; branches leaves oval, deeply concave, with short bunt hooded tips; edge cells of the branch leaves missing their cell walls.

imbricatum

U

Uncommon

papillosum

D

Locally dominant

palustre

D

Locally dominant

magellanicum

D

Locally dominant

centrale

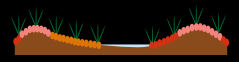
D

Locally dominant

A distinctive group, distinguished in the field by the fat branches and the hooded, deeply concave branch leaves. Confirmed microscopically by resorbed edges and backs of the branch leaves and by the presence of thickenings—fibrils—in the walls of the outer stem and branch cells.

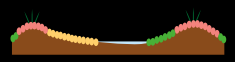
Our species are variously green, red, or brownish. They are peatland plants making carpets and mounds in bogs, fens, and wooded swamps, and often locally dominant. The red forms of *magellanicum* can be identified in the field. The green forms of *magellanicum*, and all forms of the other four species, are identified in the lab by cross sections of the leaves.

Sphagnum imbricatum is now divided into three species, *imbricatum*, *affine*, and *austenii*, using anatomical characters. Our plants are either *affine* or *austenii*, with the redefined *imbricatum* only in Alaska. *Sphagnum magellanicum* has recently been divided into three species, *magellanicum*, *divinum* and *medium*. Our plants are either *divinum* or *medium*, with the redefined *magellanicum* only in Chile and Argentina. We use the old names here.

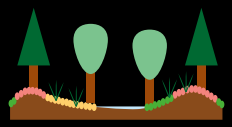


Calcareous fen

Wet bog mat

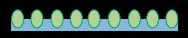


Open bog



Swamp

Sphagnum hummock



Loose wet mat

M

Must know

SPHAGNUM Section *SPHAGNUM*: *SPHAGNUM CENTRALE* Large or medium, green or gold-brown plants with slender green cells whose ends reach the surfaces of the branch leaves.

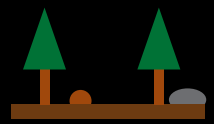
A large, relatively common species of mineral rich bogs, fens, swamps, and shores, green in the shade, golden-brown in the sun, typically forming hummocks. Can only be identified microscopically: the cell cavity of the green cells is completely enclosed by the clear cells on either side of it, but the ends of the green cell reach the top and bottom of the leaf. Be careful with *magellanicum,* which has green cells that are completely enclosed, without the extended ends.

green or golden brown, with short fat branches

green cells centered between clear cells, their ends reaching both surfaces

Boggy pool

Open bog



Boreal forest

On hummocks in swamp

Sphagnum hummock

D

Locally dominant

Microscope needed

Green or brown, never red; no good macroscopic characters.

SPHAGNUM Section *SPHAGNUM*: *SPHAGNUM IMBRICATUM GROUP* Minerotrophic species with short fat branches and a dark stem; clear cells of the branch leaves have ridges on their walls.

A species of mineral-rich waters, especially near the coast: fens, marshes, shrub swamps, forested swamps, pond shores. Identified by leaf sections: the green cells are nearly equilateral, and the clear cells adjacent to them have lengthwise ridges—comb fibrils—on their walls ( ). We treat the species inclusively: it may be further split, based on the presence of fibrils in the inner stem cortex, into *S. affine* and *S. austenii*.

green to brown, short fat branches

green cells equilaterally triangular; clear cells with ridges on their walls

On hummocks in swamp

Wet bog mat

Sphagnum hummock

U

Uncommon

Microscope needed

Short fat branches, often intense yellow-brown or orange-brown.

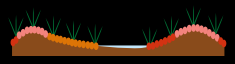
SPHAGNUM Section *SPHAGNUM*: *SPHAGNUM MAGELLANICUM* Large plants, dark red in the sun, pink when dry, green in the shade; green cells completely enclosed.

One of our commonest peatland species, found in bogs, fens, and conifer swamps. Ecologically tolerant and versatile: found in both ombrotrophic and minerotrophic wetlands, often mixes with other species, and often dominant in hummocks. The red forms, which are typically in the open, are the only red sphagnums with fat branches, and can be identified on sight. The green forms, common in the shade, look like *Sphagnum centrale* or *palustre*, and are identified by the completely enclosed green cells of the branch leaves.

red or green, with thick branches and hooded leaves

green cells completely enclosed by clear cells

On hummocks in swamp



Calcareous fen

Wet bog mat

Open bog

Sphagnum hummock

Must know

Microscope needed

The green shade form, which is often large and stringy-branched and has spreading leaves, from a shrub thicket in a rich fen.

Green *magellanicum* in the ground layer of a white-cedar swamp.

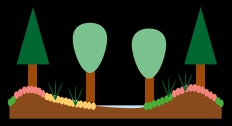
In a wet carpet on a floating bog mat, with bog bean, leatherleaf, *Carex limosa,* and *Sphagnum fallax.*

SPHAGNUM Section *SPHAGNUM*: *SPHAGNUM PALUSTRE* Large, pale-green plants of shaded pools and swamps; green cells narrowly triangular, with smooth walls.

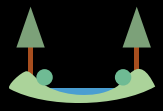
A dominant species of minerotrophic habits: woodland pools and seeps, pond shores, edges of bogs. Identified by the triangular green cells without any papillae or ridges on the walls of the adjacent clear cells. Often large and spreading, sometimes strongly squarrose. The squarrose forms resemble *Sphagnum squarrosum*, which grows in similar habitats but has branch leaves that are not hooded at their tips and do not have resorbed edges.

green to pale brown

green cells narrowly triangular, with smooth walls



Swamp



Pool with *Sphagnum*

Open wetland

Wet bog mat

Sphagnum hummock

D

Locally dominant

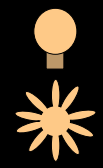
Microscope needed

Green shade forms, relatively long branched, shaggy, somewhat squarrose.

Squarrose forms, from the edge of a woodland pool. The leaves have canoe-tips and resorbed edges, and bend gradually backwards. *Sphagnum squarrosum*, similar looking but in a different group, has leaves with channeled leaf tips and intact edges that have an abrupt bend where the body narrows to the tip.

From a mixed swamp in western Massachusetts; with partridgeberry leaves and tamarack litter.

A large, common species of open, low-nutrient bogs and fens, usually pale brown or yellow, sometimes rich brown in fall, growing in extensive lawn or low hummocks, often mixed with members of the *recurvum* group. Also occurs in seepage on open rocks in the mountains. Like most members of this section, it must be identified microscopically: the papillae on the walls of the clear cells in the branch leaves are the critical character.

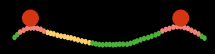


pale brown to rich golden brown; short fat branches

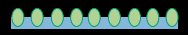
clear cells with papillose walls

Alpine zone

Wet bog mat



On bog hummocks



Wet mats

D

Locally dominant

Microscope needed

Short fat branches, often yellow or brown; not identifiable in the field.

SPHAGNUM Section *SQUARROSUM* Minerotrophic species with oblong stem leaves fringed at the ends and branch leaves with large pores; heads with conspicuous terminal buds; both species recognizable in field.

squarrosum

C

Common in right habitat

teres

C

Common in right habitat

Two widespread species of fens and minerotrophic swamps. Both have branch leaves with large ringed pores, oblong stem leaves that are fringed across the tip and conspicuous terminal buds. *Squarrosum* grows in fertile swamps and is easily recognized by the branch leaves with erect bases and abruptly recurved tips. *Teres* grows in fens, and is recognized, with more difficulty, by the large terminal bud, oblong stem leaves, brown stem, and, in the open, the yellow orange color.

F

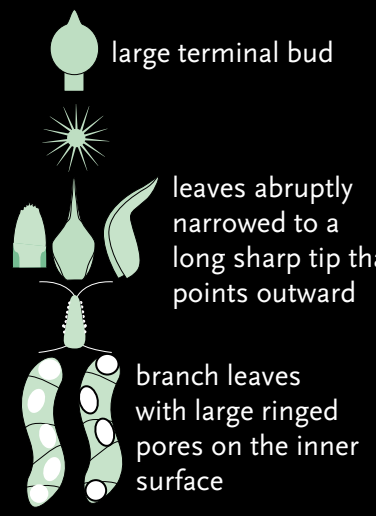
Identifiable in field

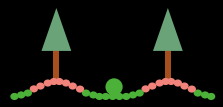
M

Must know

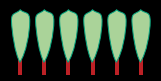
SPHAGNUM Section *SQUARROSUM*: *SPHAGNUM SQUARROSUM* Large, conspicuous plants, growing separately in swamps; leaves narrowed to long, sharp-pointed tips that are bent outwards; terminal bud large; stem leaves oblong, fringed across the tips; branch leaves with large ringed pores; often fertile.

A showy species of fertile wooded swamps, with abruptly narrowed leaf tips that bend backwards and outwards. The large terminal bud, large pores and oblong stem leaves with teeth across the tip are good confirmations. *S. palustre*, in Section *Sphagnum*, often has hooked leaves, but they are never narrowed to slender pointed tips like *squarrosum*. *S. compactum*, in Section *Rigida*, has somewhat similar tips but is a much smaller plant that grows in mats and mounds rather than individually.





In hollows in swamp



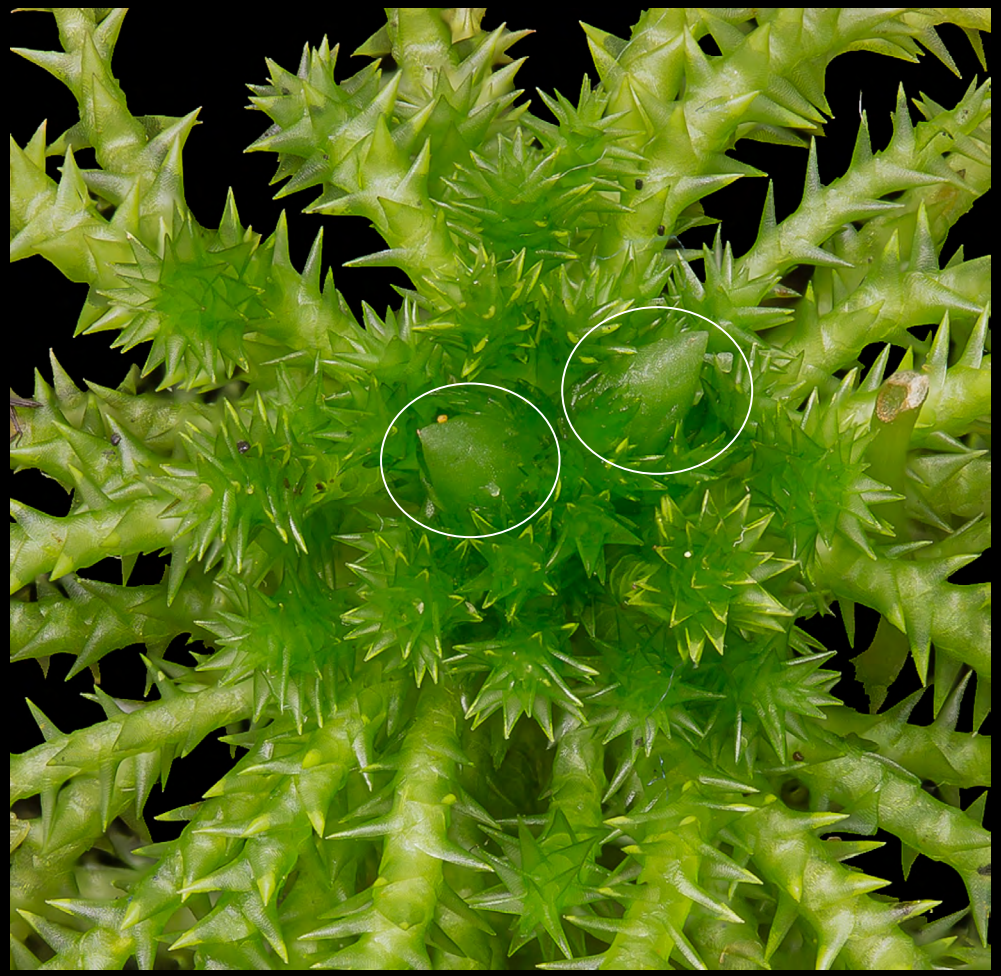
Groves

C

Common in right habitat

M

Must know



Large, green, with branches radiating in all directions and the leaves bent in the middle so that the sharp tips point outwards; large terminal buds (circled).

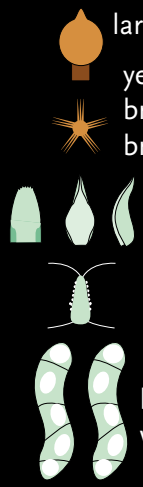
Monoicous and often fertile. Capsules, like all Sphagnums, raised on pseudopodia, without setae; some remnant archegonia are visible just below the capsules, at the swollen tips of the pseudopodia.

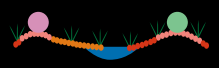
In a minerotrophic swamp in western Massachusetts, with *Calliergon cordifolium*, *Hypnum lindbergii*, and *Thuidium*.

SPHAGNUM Section *SQUARROSUM*: *SPHAGNUM TERES* Yellow to brown, on hummocks in fens; large terminal buds, oblong stem leaves fringed across their tops; branch leaves with large ringed pores, squarrose when dry, the inner walls of their clear cells minutely papillose.

terminal bud, made of the young stem leaves, with branch buds in their axils

A characteristic species of hummocks in medium fens and floating bogs. Recognized in the field by the yellow-green to rich red-brown color, the dark stem, conspicuous terminal bud, and large oblong stem leaves. Confirmed by the large branch-leaf pores. None of the other golden-brown or red-brown species with which it might be confused have both oblong stem leaves and a conspicuous terminal bud.





Hummocks in fens

Sphagnum hummock

F Identifiable in field

U Uncommon

Branches slender, stems brown, terminal bud (circled) large.

Stringy branches, large terminal buds, yellow to brown color, dry leaves slightly or strongly spreading.

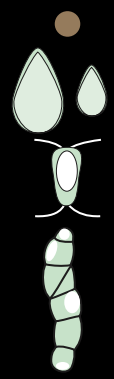
Yellow and stringy-branched, making a loose mat in a fen in eastern Maine, with (odd-looking) *Sphagnum magellanicum* and *Calliergon*.

The large fen near the whaleback in eastern Maine. *Leatherleaf and Carex lasiocarpa* dominate. *Teres* occurs on the hummocks.

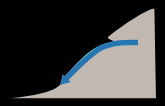
SPHAGNUM SECTION SUBSECUNDA: SPHAGNUM PYLAESII Distinctive species without a clear head; small, dark, slender, sparsely branched, the branches solitary; stem leaves large, oval, concave; branch leaves like stem leaves but smaller.

Section *Subsecunda* contains an oddball species, *pylaesii,* and a difficult group, the *subsecundum* group. They have very little in common, and we know of no characters for Section *Subsecunda* as a whole.

Pylaesii is small, dark, sparsely branched, and stringy, not looking like other sphagnums and, until magnified, not looking much like a *Sphagnum* at all. But the leaves are sphagnum leaves, and the combination of sphagnum leaves and stubby branches which are not in groups is diagnostic. It is a northern species, found on rocks with seepage, also in boggy or sandy pools. We see it commonly along the northern coast and at high elevations inland.



heads tiny;
branches short,
not in clusters;
leaves and stem
brown



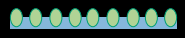
Seepy ledge

Rocks by sea

Wet sand

Boggy pool

Alpine zone



Loose wet mat

C

Common in right habitat

A mat of *pylaesii,* in seepage; with *Polytrichum juniperinum*; brown color, tiny heads, short stubby branches.

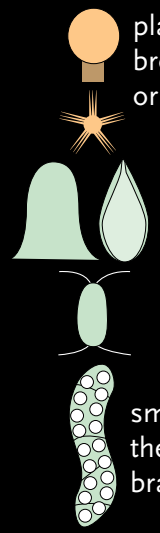
On seepy ledges, eastern Maine, with *Andreaea* and *Racomitrium venustum*.

SPHAGNUM Section *SUBSECUNDUM*: *SPHAGNUM SUBSECUNDUM* GROUP Yellow-brown, loose-leaved mosses with small pores, like beads, around the edges of the clear cells.

A complicated group of closely related species. Recognized, often with difficulty, by a shaggy look, weakly five-parted heads with short, curved branches, and somewhat hooded leaves. Confirmed, easily, by the small beadlike pores. The group as a whole is minerotrophic and reasonably common in fens and marshes, on pond shores, in wet spots in the woods, and on shaded, wet, mineral soil. Our pictures are all of *subsecundum,* the commonest member of the group.

The branch leaves are concave and hooded like those of Section *Sphagnum,* but have longer points.

stem leaves 1 mm long or less



plants green or brown, stems light or dark brown

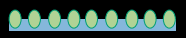
stem leaves rounded triangular, very small; branch leaves green to brownish, somewhat hooded

small pores along the edges of the branch leaf cells

Pond in bog

Pond or lake

Wet bog mat



Loose wet mat

F

Identifiable in field

C

Common in right habitat

Microscope needed

Leaves concave and hooded when wet, somewhat recurved when dry; plants messy; small branches curve over center of head; not well marked in the field; often what you have after you eliminate other possibilities.

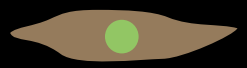
Brown color, concave leaves, irregular branching, loose wet mats.

Shade plants from along a trail; the spreading leaves suggest the *recurvum* group, but the branches run shorter and thicker and the young descending branches are not paired.

Left, *Sphagnum subsecundum*, right *Sphagnum angustifolium*, both from a rich fen in Vermont.
Subsecundum is messier and has more short incurved branches in the heads.

SPLACHNUM AMPULLACEUM Small mosses on dung; leaves sharply toothed; capsules with long swollen necks.

The dung mosses are small, northern, and rare. Most have small basal leaves with thin-walled cells and large capsules on long setae. The spores are insect-dispersed and the capsules are often colored and scented. *Splachnum*, our commonest genus, has sharply toothed leaves and capsules with greatly enlarged necks. S. *ampullaceum*, the most widespread species, grows on moose dung in swamps and beaver latrines on shores. The capsules have top-shaped necks and are pink or red when mature.



Herbivore dung

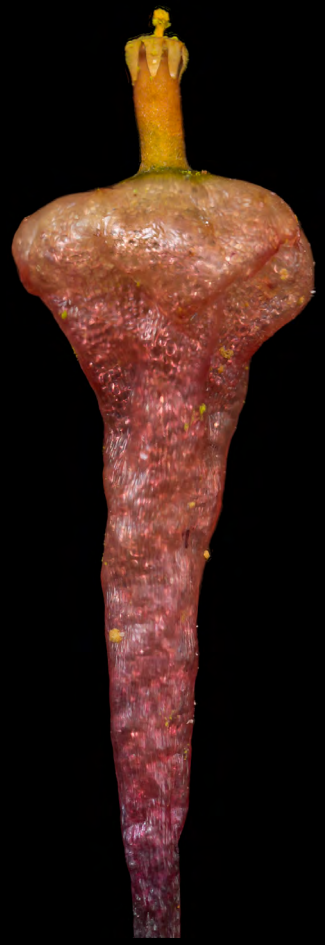
Tufts

F

Identifiable in field

R

Rare



Slender plants; translucent leaves with sharp points and teeth; neck of capsules inflated.

Left, male shoots or plants with perigonia (enlarged leaves subtending antheridia), and shorter female shoots with setae and capsules; right, a tangle of male shoots with enlarged perigonial leaves surrounding clusters of antheridia.

On moose dung in a confer swamp in the Adirondacks; grainy enlargement from a single image from 2011.

SYNTRICHIA RURALIS A papillose moss with oblong leaves, recurved edges and toothed hair points; capsules erect, with a peristome of twisted threads.

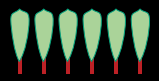
Syntrichia is common in the west but rare in the east. *Ruralis* is our only widespread species It is medium sized, grows on limy rocks in the open, and has recurved edges and a toothed hair point. *Encalypta rhaptocarpa* looks similar but grows on wetter ledges and has flat edges and an untoothed point.

peristome of twisted threads

oblong papillose leaves with long, toothed points

recurved edges

Calcareous rocks or soil



Groves

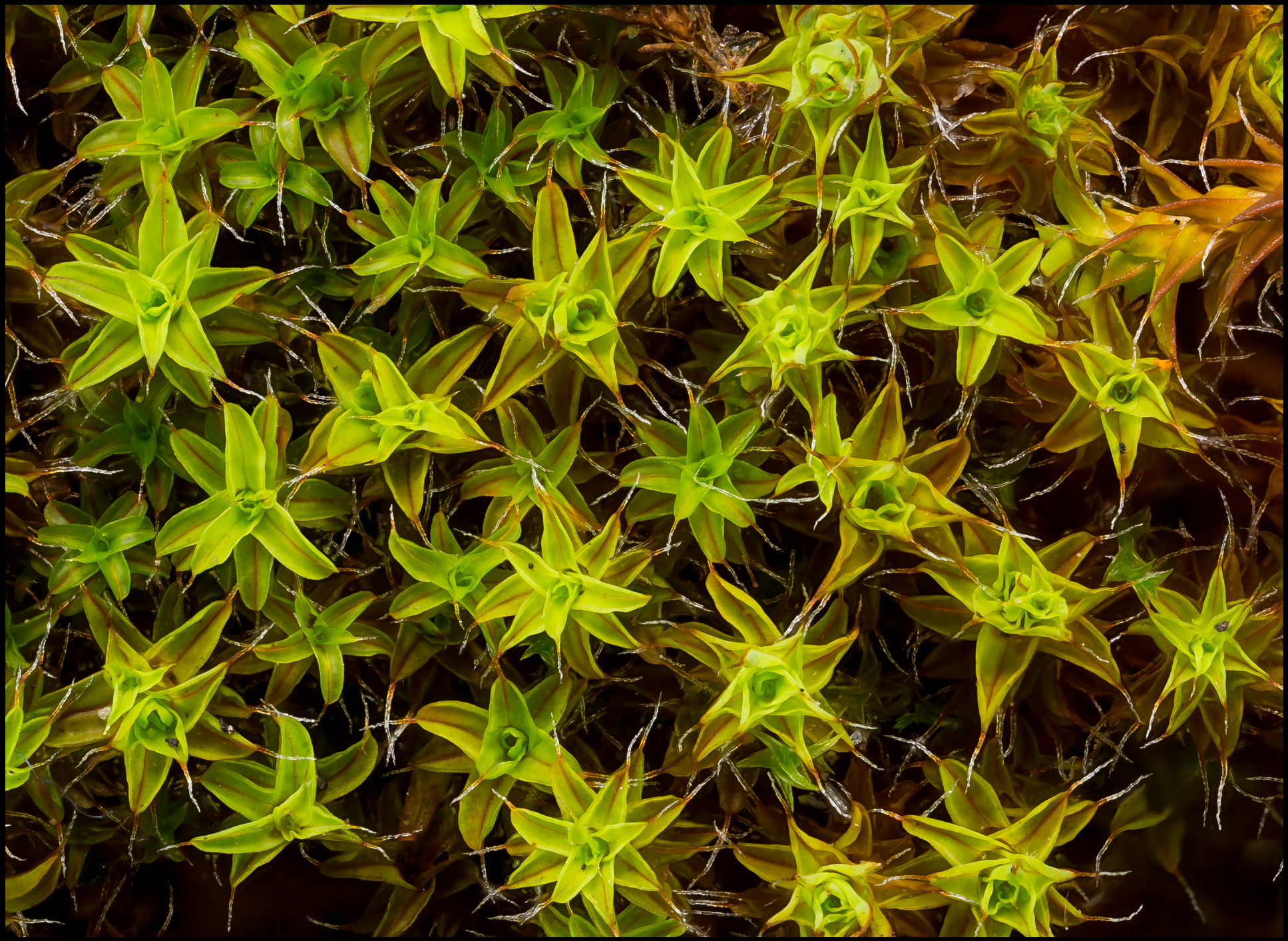
F

Identifiable in field

R

Rare

Oblong, strongly costate leaves with recurved edges and long white hair points, arching out when wet; costas and old leaves often red.

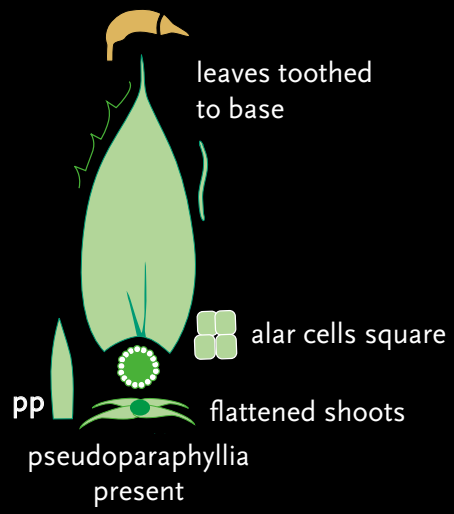


Light-green opaque papillose leaves with red costas and long white hair points.

On a marble outcrop in western Massachusetts, with *Abietinella abietina* and *Tortella tortuosa*.

TAXIPHYLLUM DEPLANATUM Shiny flattened moss of moist limy soil, often near cliffs; leaves with slender tips and small teeth to near the base; costa double; alar cells small and square.

A shiny moss with flattened shoots and overlapping leaves, similar to *Plagiothecium* but with nondecurrent leaves with much longer tips. It is regularly associated with limy seepage, and may be locally common where the habitat is right. The best characters are microscopic: lanceolate pseudoparaphyllia (pp) and toothed nondecurrent leaves with small groups of square alar cells.



Calcareous seepage

Low flat mat

Uncommon

Microscope needed

Flattened shoots, leaves with long slender tips, short double costa.

Small shoots on a shaded limy ledge, with *Anomodon rostratus* and the liverwort *Metzgeria*.

Flattened shiny shoots with closely overlapping leaves with long slender tips.

TETRAPHIS PELLUCIDA Small mosses with oval leaves, gemmae cups, and slender capsules with peristomes of four teeth.

Small plants with oval, costate leaves without borders; gemmae cups of enlarged leaves.

A small common moss, growing on well-decayed wood in forests and making big shaggy brown-green mats on stumps and logs. Plants distinctive: oval leaves, somewhat like a *Plagiomnium* without a border or teeth; gemmae cups at the tips of sterile stems; long capsules, peristomes of four teeth. Gemmae may also occur at the tips of leafy stems, without cups.

Decayed stumps and logs

Thick mats

D Locally dominant

M Must know

Female shoots small, with enlarged perichaetial leaves; capsules elongate, calyptras yellow with a white fringe.

A mat of female shoots with new capsules. The small liverwort may be *Lophozia bicrenata*.

Vegetative plants slender, leaves well spaced, often with gemmae cups of enlarged leaves at the tips of the stems, or, as here, just the gemmae without the cup.

In a mat on a log; oval leaves, like a small *Plagiomnium* but without teeth or borders.

Making thin or thick mats on stumps, brown-green in winter, lush green in summer, lots of capsules, often shaggy.

TETRAPLODON Small mosses with erect capsules with long necks, found on bones, pellets, and carnivore dung; leaves with long tips and thin-walled cells; necks of capsules dark red at maturity.

angustatus

mnioides

Rare northern dung mosses: oval leaves with long needle tips and capsules with long necks that are slightly enlarged. The capsules are green when young and dark red at maturity. Both of our species are found on carnivore dung and weathered bones and antlers, most often in alpine zones and tundra. *Angustatus* is tall, with toothed leaves and capsules on short stalks; *mnioides* is budlike, with untoothed leaves and capsules on long stalks.

capsules with long necks, red at maturity

oval or oboval leaves with long tips and large thin-walled cells; capsules with long necks, red at maturity

Carnivore dung

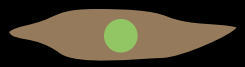
Small cushions

F Identifiable in field

R Rare

TETRAPLODON ANGUSTATUS Stems elongate, leaves toothed; setae short, capsules just above leaves.

A subarctic species, found on dung and bones in open tundra. Capsules with long necks that turn red at maturity; plants long stemmed, setae relatively short, leaves usually with a few small teeth.



Carnivore dung

Small cushions

F Identifiable in field

R Rare

Plants with young capsules, held just above the long tips of the leaves; gathered in Labrador by Matt Peters.

TETRAPLODON MNIOIDES Small, rare, and northern; plants short stemmed and budlike; leaves oval, untoothed, closely overlapping, with curly tips; setae long, capsules held high above the leaves.

An arctic-subarctic species, found on dung and bones in open tundra, reaching our area in the high mountains. Capsules with long necks that turn red at maturity; plants short stemmed, setae relatively short, leaves usually with a few small

Carnivore dung

Small cushions

Short budlike plants, setae several times as tall as the plants, necks of capsules slightly swollen, deep red purple.

Plants short and budlike, forming a mat or turf. Fruiting plants may be taller.

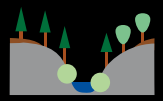
Growing on what is likely a carnivore latrine on a bog hummock in Newfoundland, with *Polytrichum juniperinum* and mountain cranberry.

THAMNOBRYUM ALLEGHANIENSE Large shaggy frondose moss, making mats or fringes on rocks; leaves oval, sharply toothed, with small diamond-shaped cells.

A big shaggy frondose moss, common on rocks in the spray zone of streams, especially in gorges and near waterfalls. Also on stream banks and in cracks in cliffs. The oval leaves with jagged teeth and flattened, loosely pinnate sprays of branches are distinctive.

oval leaves with sharp teeth, strong costas, and small, diamond-shaped cells

Rocks by water



Gorges and cascades

Arching fronds

Shingles

D

Locally dominant

M

Must know

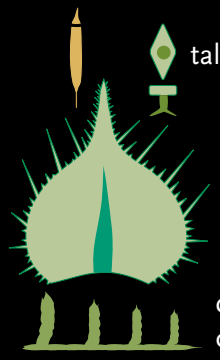
Shoots flattened, frondose, irregularly pinnate; leaves large, oval, with coarse teeth near their tips.

Fronds shingled on wet rocks.

On a rock in a shaded brook, submerged at high water; *Thamnobryum* is highest, with *Bryhnia novae-anglia* (slender branches, treelike) below it and *Torrentaria riparioides* (wet, sparsely branched, loose mats) near the summer water level.

THELIA ASPRELLA Silver-green, opaque, cylindrical shoots; heart-shaped, papillose leaves with spiny teeth; in dense mats on tree bases.

A small, distinctive moss that makes thick, dense mats—stockings—on the bases of trees. Leaves heart-shaped, cells with single tall papillae that may branch, stems with paraphyllia, leaves with long spiny teeth. Common in dry woods in the oak zone, absent northwards.



Stockings

Thick doormat

C

Common in right habitat

M

Must know

Silvery green and opaque; cylindrical shoots; leaves with spiny teeth.

Tall papillae make the leaves look frosted.

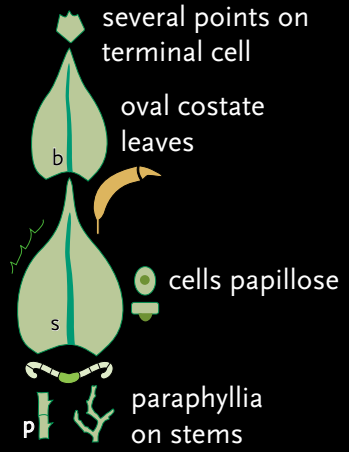
On the base of an oak; long cylindrical capsules with white peristomes.

THUIDIUM Large mosses making fernlike fronds with twice-pinnate branching; cells with single papillae over the centers; branched paraphyllia (p) on stems, making them look fuzzy.

Large frondose mosses common on the forest floor, also on boulders, tree bases, logs, and ledges. The leaves are small, oval, and opaque. The cells have single papillae, and the stems have a dense woolly covering of paraphyllia. The regularly twice-pinnate, fernlike fronds combined with strongly costate stem leaves are unique. *Hylocomium brevirostre* and *umbratum*, which are also twice pinnate and have paraphyllia, have short double costas and look quite different.

delicatulum

recognitum



Rocks, trees, and soil

Loose thatch

D Locally dominant

M Must know

THUIDIUM DELICATULUM Twice pinnate, stems with paraphyllia, leaf cells with single papillae; costas not reaching leaf tips, cells of paraphyllia with papillae near the middle.

A common species in moist deciduous woods, forming large deep mats on tree bases, rock, and logs. The best field characters for the genus are the twice (or thrice) pinnate arching fronds, the dull surface, and its growth on wood or acid rocks. *Hylocomium splendens*, our other common multiply pinnate species, is shiny and three-times pinnate. Species identification is harder. *Delicatulum* is common on rocks, soil, tree bases, and logs in moist woods, often forming large patches. It has short costas that don't reach the tips of the stem leaves, and paraphyllia with the papillae near the middle of the cells.

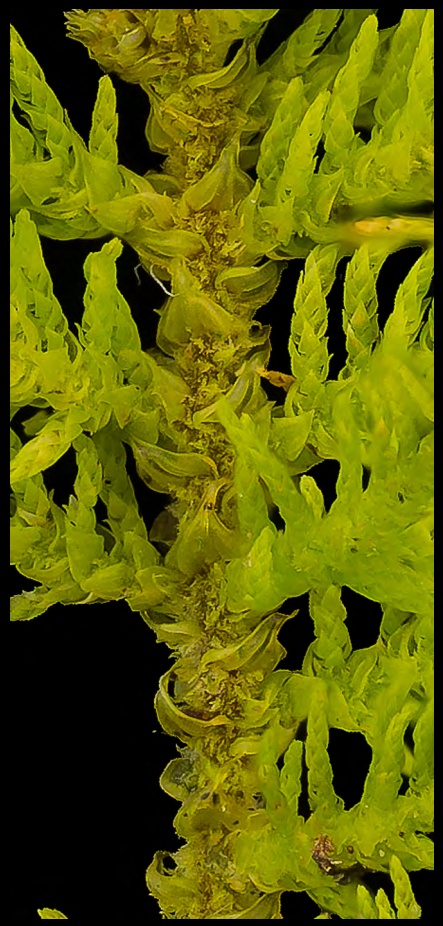
stem leaves don't arch outwards when dry; costas don't reach the tips

the woolly stuff on the stem, between the leaf bases, is a mat of paraphyllia

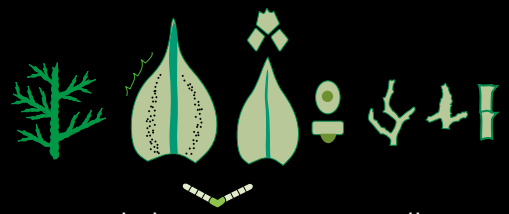
Twice-pinnate fronds, opaque when dry, dark when wet.

On the floor of a minerotrophic swamp. With *Sphagnum girgensohnii*.

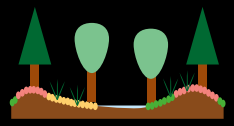
THUIDIUM RECOGNITUM Very similar to *Thuidium delicatulum*; costa fills the apex of stem leaves, paraphyllia have papillae at upper ends of cells.



Similar to *delicatulum* but less regularly pinnate, often yellow or even orange, and differing in two microscopic features: the costa which fills the tip of the leaves, and the papillae on the paraphyllia, which are at the upper ends of the cells. Seen regularly on dry limy hills, also reported from cedar swamps and wet calcareous boulders.



Irregularly twice pinnate, papillose leaves, costa fills tip, cells of paraphyllia papillose at upper ends



Swamp

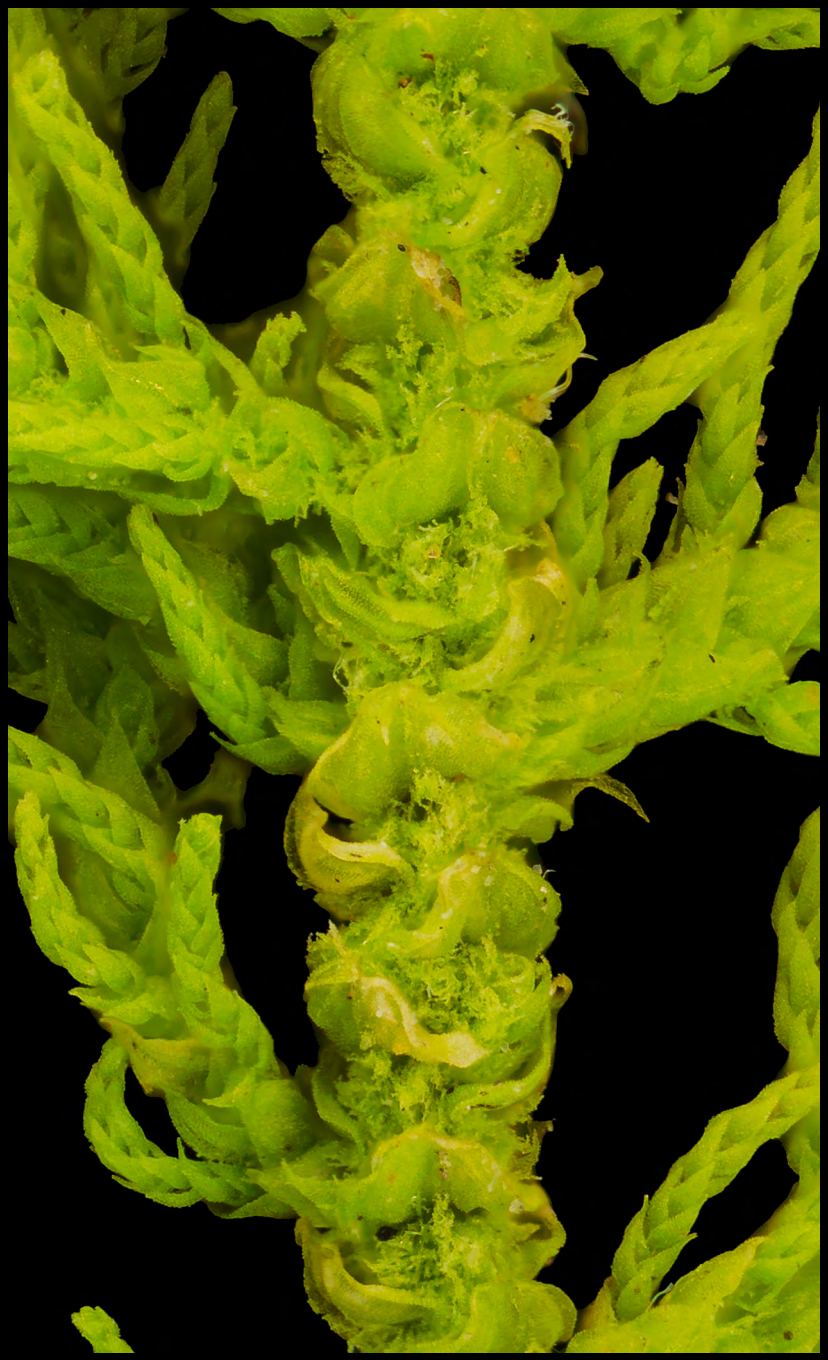
Calcareous rocks or soil

Arching fronds

C

Common in right habitat

Microscope needed



Often yellow or orange; tips of stem leaves filled with costas; dry stem leaves tend to point out from the stem at their bases and then arch inwards.

With *Rhodobryum* on a dry limy boulder.

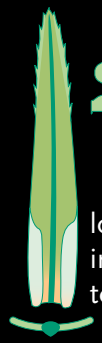
With *Abietinella abietina* and maidenhair spleenwort on a calcareous outcrop.

With *Leucobryum glaucum* on dry-rich ledges.

TIMMIA MEGAPOLITANA Large and distinctive, leaves long, sharply toothed, inrolled when dry, clasping at the base; short capsules with erect calyptra.

A large, uncommon moss, almost always found on ledges, in fertile soil along brooks, in woodland seeps, and in river gorges, usually where there is calcareous seepage. Leaves oblong, clasping and with clear cells at the base, upper cells mammilose (bulging), inrolled when dry, making the plant look like a funny *Polytrichum*. Capsules short cylindric, calyptras persist and stick up.

calyptra points up

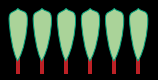


small, round bulging cells

long leaves, clasping at their bases, toothed above

Calcareous seepage

Limy rocks by water



Groves

F

Identifiable in field

U

Uncommon

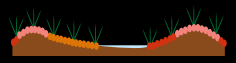
Dry plants with inrolled leaves.

Tall, broadly lanceolate leaves with incurved edges.

Cylindrical capsules, erect calyptras, leaves rolling inwards at tips.

TOMENTYPNUM NITENS Large species of rich fens with pinnate branching and long straight slender-tipped leaves.

A large distinctive moss that grows on hummocks in rich fens. Plants tall, golden yellow to brown, pinnately branched; leaves slender and straight, with a single costa and pleats; branches look like brooms. Often grows with *Sphagnum warnstorfii, Calliergon giganteum, Calliergonella cuspidata*, and other calciphiles.



Calcareous fen

Pipe cleaners

C Common in right habitat

M Must know

Golden brown, pinnately branched, long, slender pleated leaves.

TORRENTARIA RIPARIOIDES Large stringy moss found on wet rocks in brooks; oval leaves with a single costa, small teeth, and no border.

A common moss in brooks, growing low on rocks, submerged at high water. Recognized by the loosely arranged, oval, costate leaves that spread widely when wet. *Platylomella* can be similar but is smaller and has bordered leaves. Some Hygrohypnums have similar leaves; their leaves are typically less spreading and either have double costas or differentiated alar cells.

Rocks in streams

Shingles

C

Common in right habitat

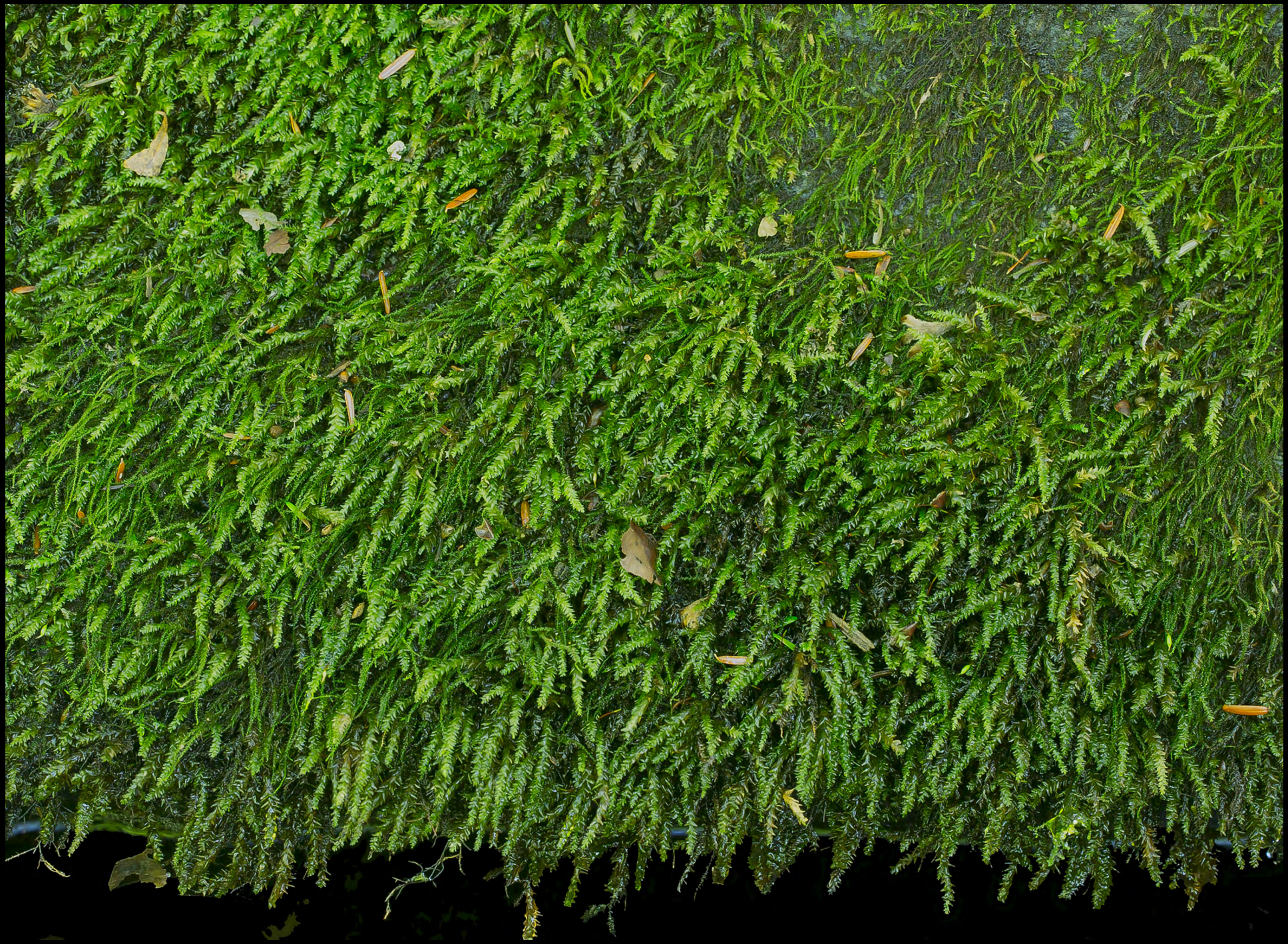
M

Must know

Broadly oval, costate, concave leaves whose tips are not curved or secund; old plants dark green.

Concave leaves, long-beaked capsules.

Forms mats or fringes low on rocks near the summer low-water level; submerged at middle levels.



A fringe on a boulder in a shaded stream. *Torrentaria* is fairly large; the small stringy plants are *Hygroamblystegium tenax* or *Platylomella lescurii*.

TORTELLA Obligate calciphiles; lanceolate leaves, clear basal cells extending up the margins in a v, multipapillose upper cells.

fragilis

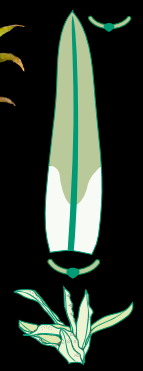
R

Rare

humilis

U

Uncommon



Tortella includes mosses with opaque, light yellow-green, papillose leaves whose lower cells are clear and thin walled and extend up the margins in a v. The capsules are erect and slender, with a long beak on the calyptra and a peristome of twisted threads. All our species live on limy rocks or in limy seepage.

Calcareous seepage

inclinata

R

Rare

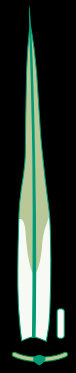
tortuosa

C

Common in right habitat

M

Must know

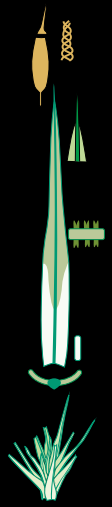


Calcareous rocks or soil

Alvar

TORTELLA FRAGILIS Leaves slender and needle tipped, not twisted when dry; many thickened near the tip, forming a propagule which breaks off.

A wide-ranging species, scattered and uncommon with us, growing in a variety of intermittently wet, limy places. We find it in small quantities in the crevices of limy cliffs, often in seepage. Farther north it makes turfs in limy barrens. Recognized by the straight erect leaves with thickened tips that break off. The leaf blade is two-cells thick just below the tip.



leaves slender, two-layered above, erect and not much curved when dry, ending in thickened needle tips which break off

Calcareous seepage

Calcareous rocks or soil

Turf

F

Identifiable in field

U

Uncommon

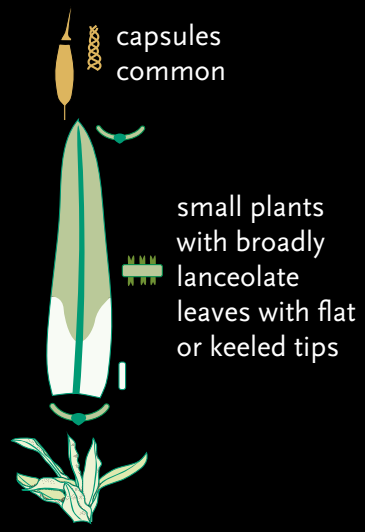
Plants small, yellow-green, stiff leaved, erect; leaf tips several cells thick, breaking off.

Forming a dense turf in crevices in a limestone barren, western Newfoundland.

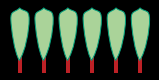
With tips that broke off while transporting the specimen; the tips are multistratose.

TORTELLA HUMILIS Small plants with leaf tips sharp pointed but not ending in a needle tip; tips of leaves v-folded but not forming a hood or a canoe end; capsules common.

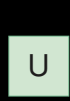
A small *Tortella* without the long cork-screw tips of *tortuosa* or the broken ones of *fragilis*. Small plants, often in dense cushions, found on limy rocks and soil, either in the open, or in crevices or under shrubs. Almost always fertile. *Inclinata* is about the same size and also has short-tipped leaves; it has hooded tips to the leaves, makes very dense cushions, and almost never fruits.



Calcareous rocks or soil



Groves



Uncommon

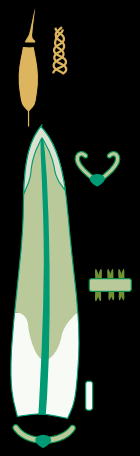
Microscope needed

Yellow-green plants with lanceolate leaves on limy soil; often fertile; peristome of twisted threads.
B*arbula* (less tapering leaves) and *Tortella inclinata* (hooded leaf tips) are similar.

Leaves long, tapering rather than parallel-sided, flat or folded at the tips but not hooded.

TORTELLA INCLINATA Small yellow-green plants in dense clumps and mats; leaf edges inrolled at tips, forming a hood or a canoe tip, sometimes ending in a tiny needle point; almost never fruits.

A small moss of open limy cliffs, flat-rock barrens, and alvars, recognized by the relatively broad short leaves that are inrolled and hooded at their tips. It is a wide-ranging northern and western species, rare in the east. It grows in dense bright-colored cushions, always sterile, on open, intermittently wet, limestone ledges and alvars.



short leaves with hooded tips; upper surface of costa covered with elongate smooth cells; almost never fruits

Calcareous rocks or soil

Alvar

Small cushions

F

Identifiable in field

R

Rare

Small plants in dense mounds or mats, some of the leaves with hooded canoe tips; often with a tiny needle point on the extreme tip. The thallose liverwort is likely *Preissia quadrata*.

Tightly curled when dry.

In dense mats or mounds, sometimes within other mosses.

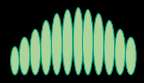
On a marble knoll in southern Vermont, with *Schistidium crassithecium* (black), creeping juniper, shrubby cinquefoil, and a turf of *Carex scirpoidea*.

TORTELLA TORTUOSA Large and common, with long needle tips that do not break off, twisting into corkscrews when dry.

Our largest and commonest *Tortella,* forming patches and mounds on open ledges and limy soil. It is light yellow-green and has slender leaves with needle tips that are s-curved when wet and twisted like corkscrews when dry. The microscope shows needle tips that are not thickened and the typical clear basal cells extending up the edges and making a v.

Calcareous rocks or soil

Large cushions



Loose mounds

D Locally dominant

M Must know

Leaves with long needle points and spiral or s-curves, even when wet.

Light yellow-green in the sun, in loose mounds; tips curl like corkscrews when dry.

On open limy ledges with intermittent seepage; some small plants of *Encalypta procera* are visible in cracks at the bottom.

On open limy ledges with intermittent surface flow; with *Schistidium* (black), *Rhytidium rugosum* (golden), and *Senecio pauperculus* (woolly).

Small mosses of disturbed soil; leaves with an oval base, abruptly contracted to a narrow tip; costa expanding to fill the tip. Capsules long necked, with a small bump at the base of the neck. Both grow on roadsides and in fields and gravel pits, usually on moist mineral soil in the open sun. *Ambiguus*, with the neck about equal to the urn, is by far the commoner species. *Longicollis*, with the neck 2× or more as long as the urn, is southern and rare. The leaves are much like *Ditrichum* or *Dicranella*, though more abruptly contracted to the tip; the long-necked capsules are distinctive.

ambiguus

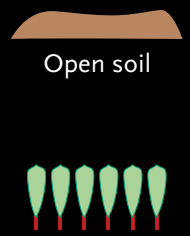
C Common in right habitat

F Identifiable in field

longicollis

R Rare

F Identifiable in field



F Identifiable in field

TREMATODON AMBIGUUS Neck about as long as urn, leaves tapering gradually into a long, untoothed tip.

An inconspicuous moss of open, disturbed mineral soil. Almost impossible to recognize without capsules. Roadsides, gravel pits, and ditches are common habitats. Leaves with an oval base, abruptly contracted to a narrow tip; costa expanding to fill the tip. Capsules long necked, with a small bump at the base of the neck. The leaves are much like *Ditrichum* or *Dicranella*, through more abruptly contracted to the tip; the long-necked capsules are distinctive.

Open soil

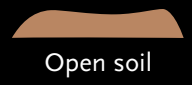
Tufts

F Identifiable in field

C Common in right habitat

TREMATODON LONGICOLLIS Small plants with leaves that taper gradually to toothed points and slender capsules with the neck several times as long as the urn.

The rarer of our Trematodons, often found growing with *T. ambiguus* when found at all. Like that species, grows in small tufts on open, moist mineral soil and has slender leaves and long-necked capsules. Differs from it in the shorter-pointed, more gradually tapering leaves and capsules with the neck several times as long as the urn.



Open soil

Tufts

F

Identifiable in field

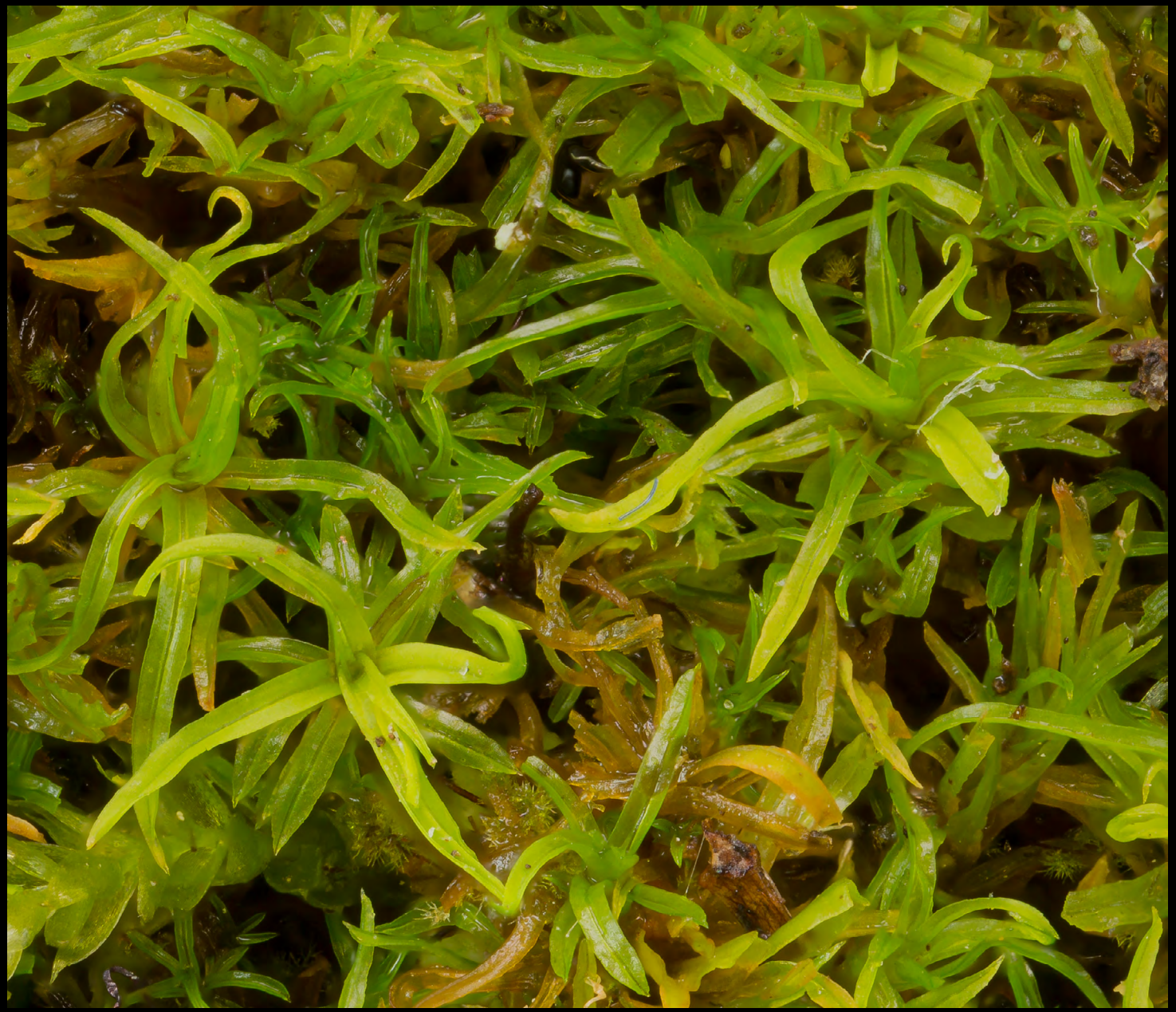
R

Rare

Gradually tapering leaves, the points winged with leaf tissue to near the tip.

Small plants in tufts of soil; necks of capsules several times longer than urn.

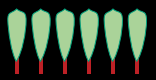
TRICHOSTOMUM TENUIROSTRE Small papillose moss with flat leaf edges; tips of the leaves often broken off.



Leaves linear lanceolate, not sharply folded or with recurved edges; some tips broken off.

A slender-leaved papillose moss of tree bases and rocks, similar to *Gymnostomum, Hymenostylium, Tortella*, and others, often recognizable in the field by the broken leaf tips. Wide ranging in temperate North America and common in the southern half of the NFR. Confirmation requires the microscope: the multipapillose upper cells, large clear area at the base, and plane edges are good characters.

Rocks, trees, in shade



Groves

F Identifiable in field

C Common in right habitat

Microscope needed

With *Rhizomnium punctatum*, *Plagiochila asplenioides*, and *Campylium chrysophyllum*.

Loose mats or turfs; lanceolate linear leaves, not strongly folded; many tips broken off.

ULOTA Small mosses forming dark cushions on rocks or trees with lanceolate leaves and short, rounded, often papillose cells; calyptras hairy, capsules exserted, tapering gradually into the setae; stomates always superficial.

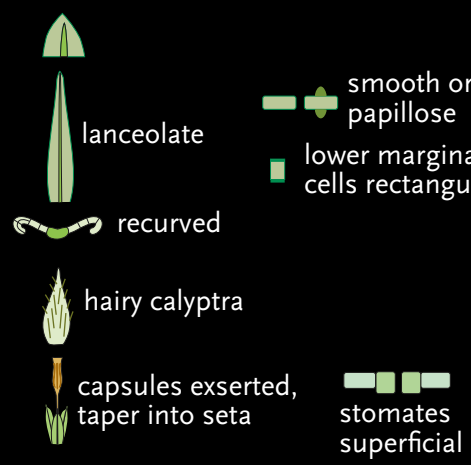
A common genus of small, dark, cushion-forming mosses of dry rocks and tree trunks, closely related to *Orthotrichum* and overlapping in most of its characters. In general, dark, lanceolate, single-or-doubly papillose mosses in little tufts or cushions on trees or rocks are one of the two. If the leaves are curly, the calyptras very hairy, the basal marginal cells square, or the basal cells near the costa angled outward it is likely *Ulota*.

M

coarctata Must know

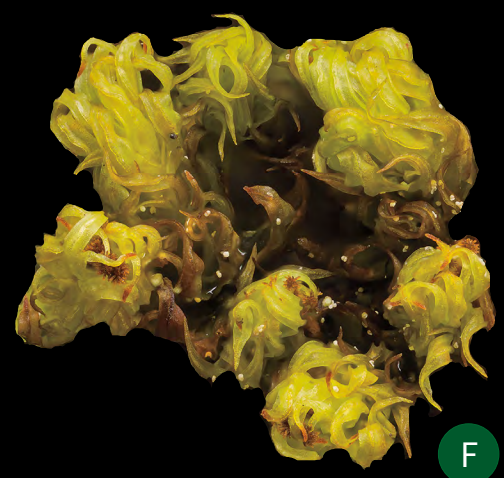
M

crispa Must know



M

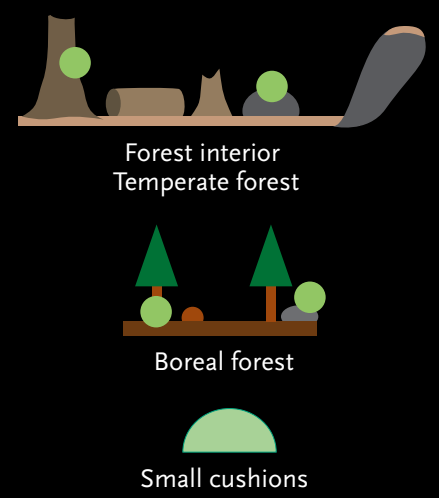
hutchinsii Must know



F

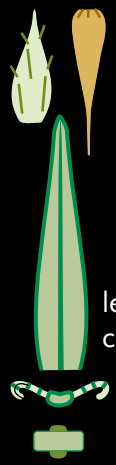
R

phyllantha Identifiable in field Rare



ULOTA COARCTATA Small mosses in loose cushions on trees; leaves only slightly crisped when dry; capsules gradually tapering to a long base, only ribbed near the mouth, and strongly puckered at the mouth when dry.

A tree-bark moss, resembling *Ulota crispa* and often growing with it but less common. It differs from *crispa* most strongly in the capsules which are club shaped, puckered at the mouth, and smooth when dry. Those of *crispa* are cylindrical, ribbed, and have open mouths when dry. (The wet capsules of the two can look surprisingly alike and you need to be careful.) The leaves of both *coarctata* and *crispa* are relatively light colored, but those of *crispa* curl up tightly when dry, and seem to form somewhat tighter cushions.



Trees

Small cushions

F

Identifiable in field

M

Must know

Club-shaped capsules, puckered at the mouth, only ribbed at the top, tapering gradually into the seta.

Loose cushions, club-shaped capsules with long tapering bases, hairy calyptras, dry leaves not strongly curled.

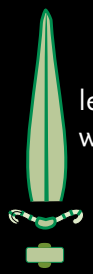
Loose, fertile, straight-leaved cushion of *coarctata* below a tighter cushion of *crispa* with curly leaves.

ULOTA CRISPA Lanceolate, papillose leaves that curl when dry, fully exserted capsules that are ribbed when dry, hairy calyptras.

A very common epiphyte of tree bark, found in almost every forest stand. Recognized as a *Ulota* by small rounded cushions and lanceolate, papillose leaves that curl when dry, and the hairy calyptras and exserted capsules. Separated from the less common *Ulota coarctata* by the ribbed capsules that are cylindrical or narrowed to the mouth; those of *coarctata* are smooth and club shaped, and then puckered or contracted to a small mouth.

hairy calyptras

capsules exserted, ribbed and cylindrical when dry



leaves curly when dry

Trees

Small cushions

C

Common in right habitat

M

Must know

Leaves curly when dry; hairy calyptras; dry capsules strongly ribbed, long tapering at base, not puckered at mouth.

Curly when dry; hairy calyptras. With *Frullania eboracensis* and a *Parmelia*, perhaps *sulcata*.

Dry leaves curly, dry capsules strongly ribbed, tapering to the setae, not contracted to their mouths.

New capsules with hairy calyptras; moist leaves still curl near their tips.

Exserted capsules, hairy calyptras, curled leaves. With the liverwort *Frullania eboracensis.* No *Orthotrichum* has capsules this hairy or leaves this curly.

ULOTA HUTCHINSIAE Dark, straight leaves, hairy calyptras, dry capsules with eight ridges and eight reflexed teeth.

Our commonest *Ulota* of acid rocks, also occasionally on trees. Plants dark, straight-leaved dry or wet, in small cushions; calyptras densely hairy, dry capsules cylindrical, with eight ribs and eight reflexed teeth. *Orthotrichum anomalum*, which grows on limy rock, is similar but has less hairy calyptras, capsules with more than eight ribs and eight teeth, and teeth that stick out or up but are never reflexed.

Shaded boulders and ledges

Small cushions

C

Common in right habitat

M

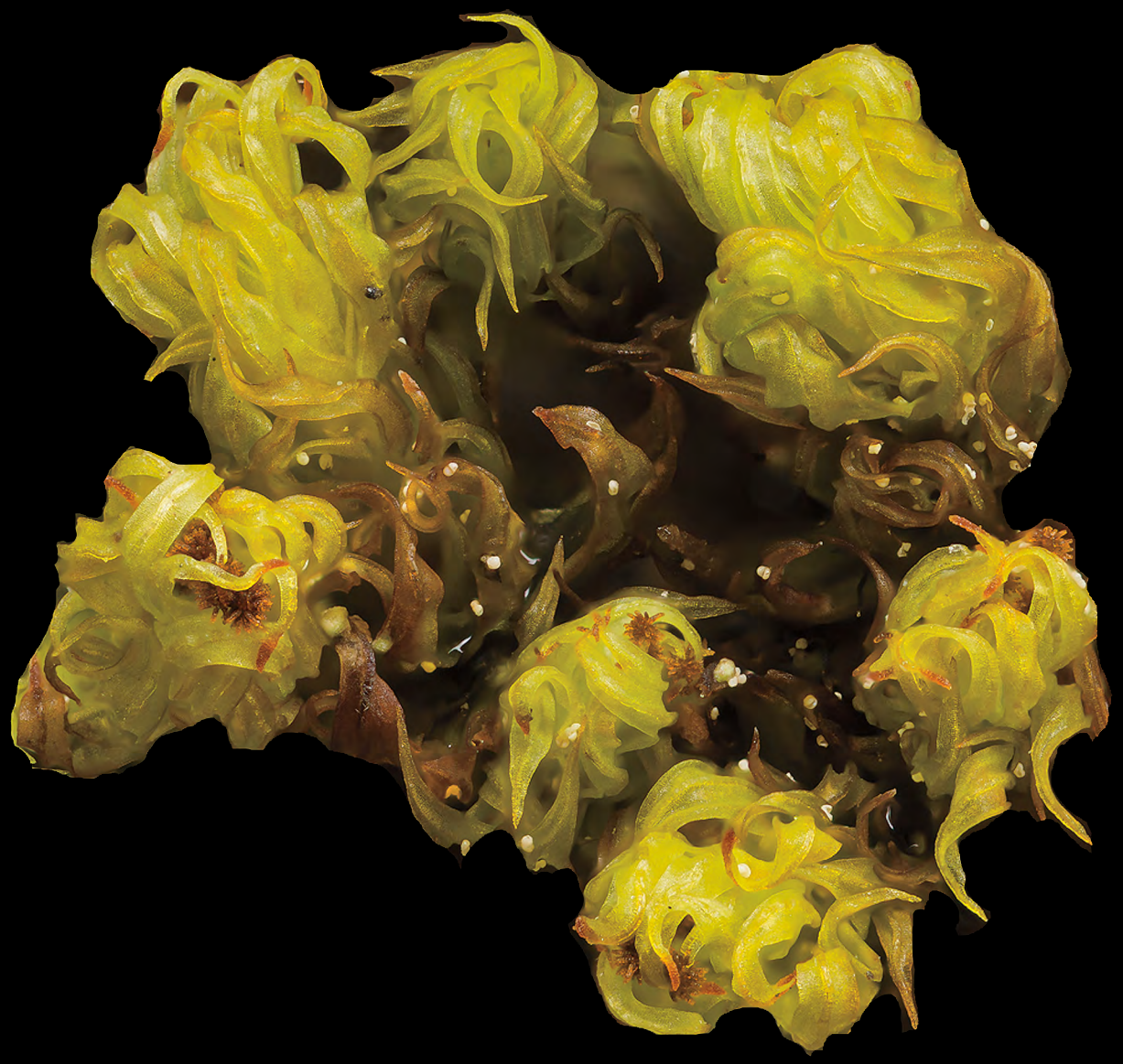
Must know

Dark, straight leaves, ribbed capsules tapering gradually to setae.

Dense, dark colonies.

New capsules with hairy calyptras, old capsules with ribs and reflexed teeth.

ULOTA PHYLLANTHA A small rare northern species of rocks and trees near the sea; leaves with red tips that bear radiating clusters of brood branches.



A northern species, strongly curly when dry, with elongate brood bodies on the tips of the youngest leaves. Forms patches on rocks by the sea, often within the spray zone but never submerged. Also reported from trees in coastal forests. *Schistidium maritimum* lives in the same habitat; it forms denser cushions and lacks brood bodies. Both seem to be rare. There are a lot of rocks on the northern coasts but very few have *Ulota* or *Schistidium*.

F Identifiable in field

R Rare

Plants small, in flat mats; dry leaves curly, with clusters of brood bodies at their tips, and red tips after the brood bodies disperse.

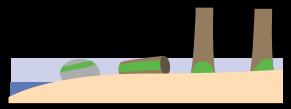
With squamules of a *Cladonia* lichen.

Growing over *Parmelia saxatilis* on granite near the sea; Great Wass Island, Maine.

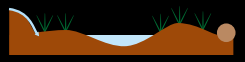
Coastal ledges and boulders, Great Wass Island, Maine. The upper shore, above storm tides but still in the splash zone, is the habitat for *Ulota phyllantha* and *Schistidium maritimum*.

WARNSTORFIA FLUITANS GROUP Aquatic mosses with long, slender, often hooked leaves; costa single, with rhizoid initials near the tips; alar cells enlarged.

Sickle-leaved costate mosses formerly included in *Drepanocladus,* and like it with inflated alar cells that extend to the costa and small thick-walled cells in the stem cortex. Common in all sorts of wet places: ponds, pools in wetlands and forests, slow streams, ditches. Separated from *Drepanocladus* microscopically by the large clear cells—rhizoid initials—near the stem tips. We have two species, *fluitans* and *exannulata,* that are supposed to differ in the development of the alar cells. We don't have much faith in the distinction and consider them a group.



Intermittently submerged trees, shrubs, and wood



Open wetland

Pond or lake

Trailing in water

C

Common in right habitat

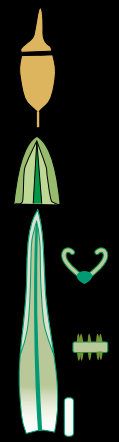
Microscope needed

Slender stems and leaves, in tangles on submerged or intermittently submerged wood and litter; leaves straight or falcate secund; can't be separated from *Drepanocladus* macroscopically.

Straight-leaved plants are similar to *Leptodictyum riparium* and must be separated microscopically by the rhizoid initials and enlarged alar cells.

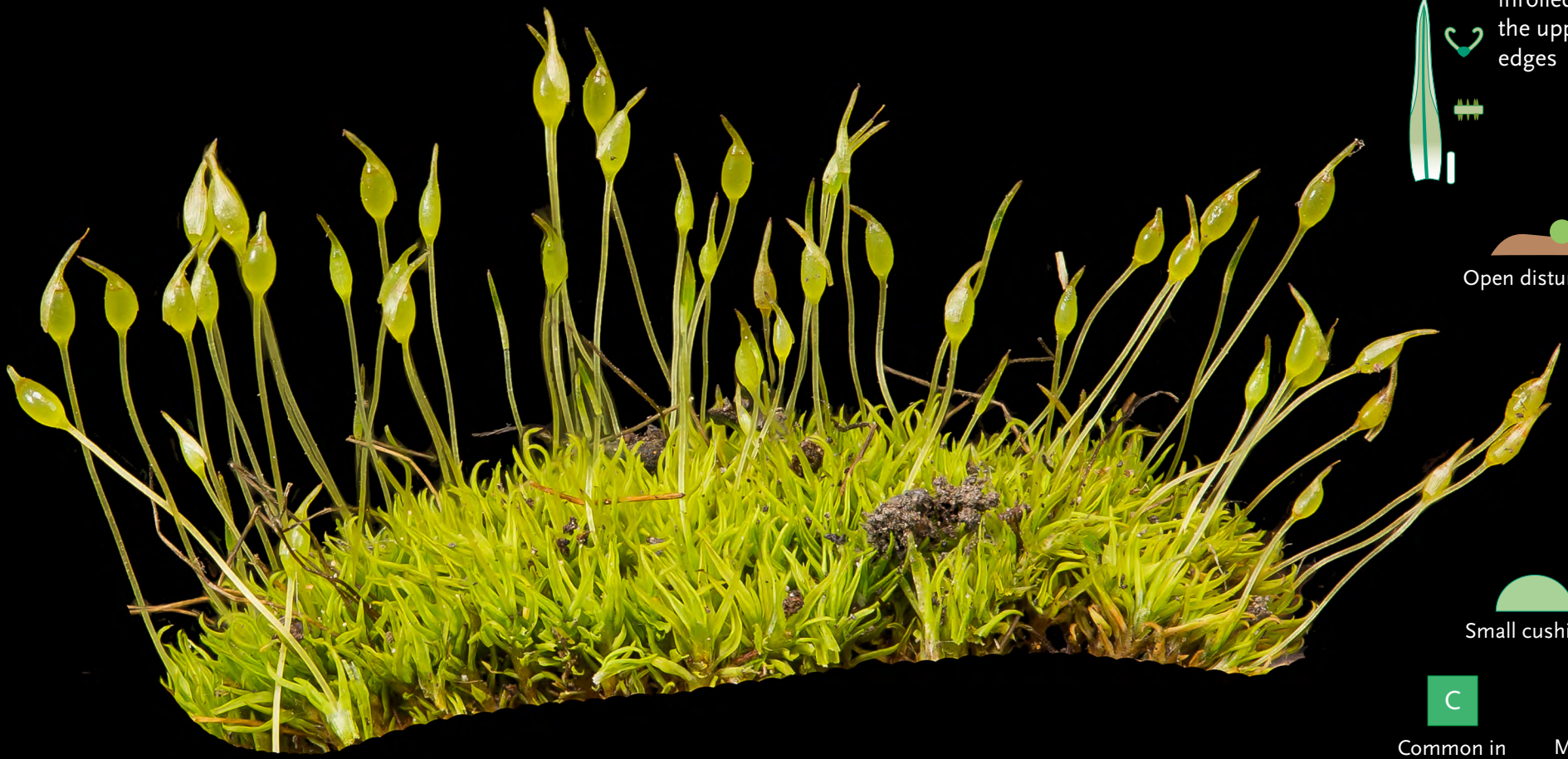
WEISSIA CONTROVERSA Light yellow-green, papillose, opaque when dry; leaves slender, with inrolled edges, curling into tubes when dry; capsules oval, erect, on yellow setae.

A small weedy moss that makes bright yellow-green patches in fields, borrow pits, river shores, and gravelly soil along roads and railroads. The leaves are slender, densely papillose, curled when dry, and strongly inrolled along their upper edges, wet or dry. It is found in all sorts of places but particularly common in open limy soil. *Tortella inclinata*, a rare moss of limy habitats, has hooded tips that are somewhat similar. It grows in denser clumps and has shorter, broader leaves than *Weissia*.



plants light green, opaque; leaves slender, papillose, inrolled along the upper edges

Open disturbed soil



Small cushions

C

Common in right habitat

M

Must know

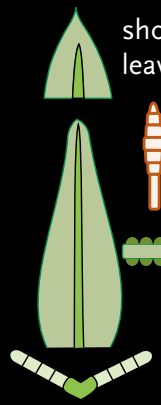
Light yellow-green, leaf tips roll into tubes when dry.

In intermittent minerotrophic seepage on a road cut; light yellow-green color, often fruits abundantly.

Often in open places that are intermittently wet; yellow leaves and setae, oval capsules.

ZYGODON CONOIDEUS Small and rare, forming mats or patches on tree bark; leaves short, with broadly acute tips and flat edges; cells multipapillose; brood bodies often found in axils.

A small rare moss forming patches on tree trunks and, reportedly, concrete walls. Leaves short, blunt, flat edged, erect when dry; upper cells small, rounded, thick walled, multipapillose; club-shaped brood bodies often found in leaf axils. In the field it looks like a small *Orthotrichum* in patches rather than tufts.



Thin doormat

Trees

Must know

Microscope needed

Small, dark, with short leaves that are erect and not much curled when dry. Like a small *Orthotrichum* but forming patches.